Mr 21 '22

The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

Vol. XIX. No. 3
$2.00 a year 20 cents a copy

MARCH, 1922

Published at Cooperstown, N. Y.
New York Office, 1123 Broadway

Fig. 2176

Automatic Electric Condensation Pumps

ECONOMY Automatic Electric Condensation Pumps are compact and self contained, with simplicity and efficiency as the keynotes of the design. They are constructed of the best materials obtainable without extravagance. The pump is a bronze fitted ring oiling machine which has a capacity greatly in excess of the maximum amount of condensation which will reach it. The whole machine has a strength which gives long life while at the same time it is light enough to make handling and installation easy.

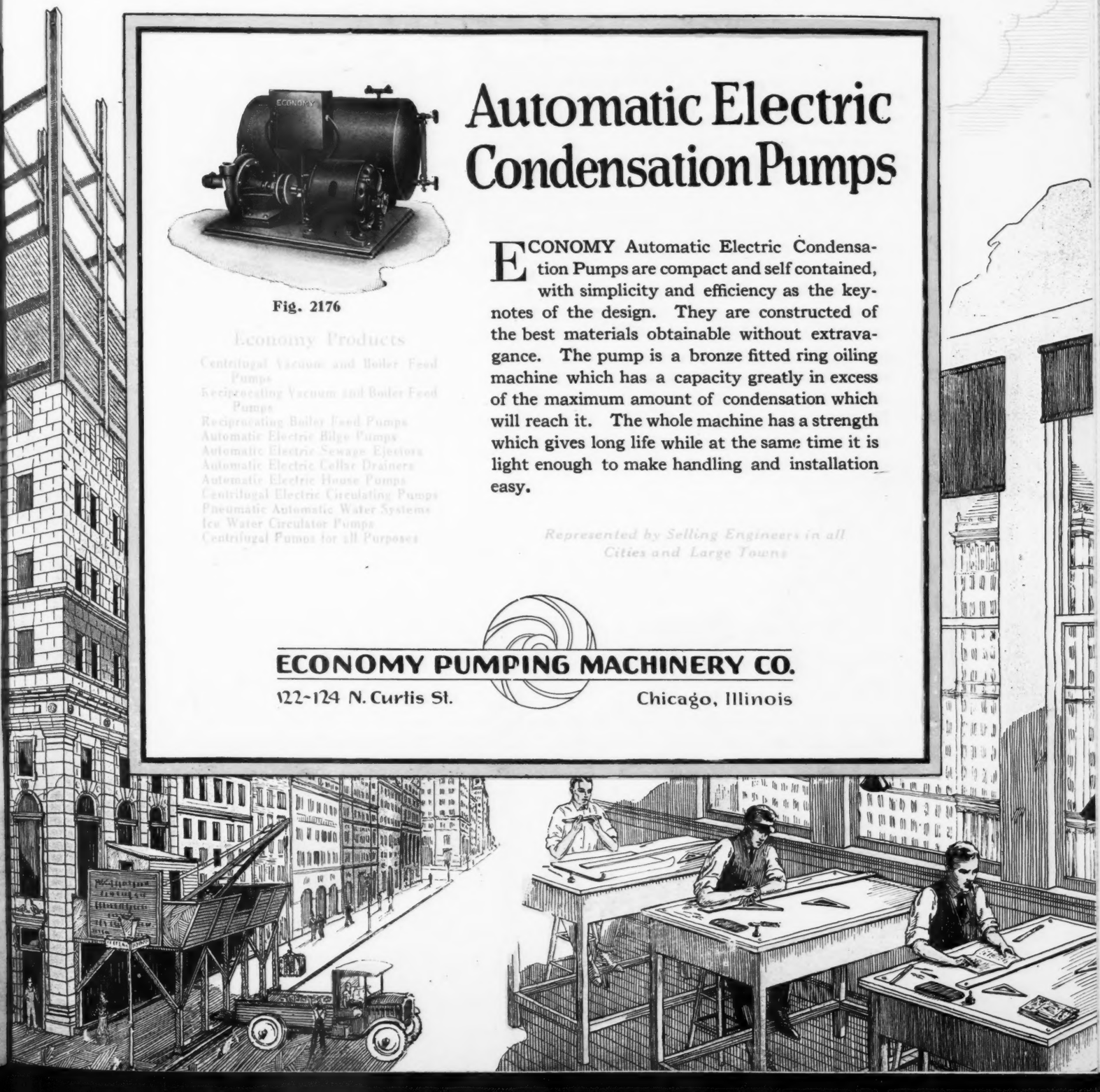
Economy Products

Centrifugal Vacuum and Boiler Feed Pumps
Reciprocating Vacuum and Boiler Feed Pumps
Reciprocating Boiler Feed Pumps
Automatic Electric Bilge Pumps
Automatic Electric Sewage Ejectors
Automatic Electric Cellar Drainers
Automatic Electric House Pumps
Centrifugal Electric Circulating Pumps
Pneumatic Automatic Water Systems
Ice Water Circulator Pumps
Centrifugal Pumps for all Purposes

Represented by Selling Engineers in all Cities and Large Towns

ECONOMY PUMPING MACHINERY CO.

122-124 N. Curtis St. Chicago, Illinois



Selecting the Fan Equipment

PERHAPS, no equipment installed in public buildings is of greater importance than the fan apparatus. Upon the successful operation of the fan system depends, to a marked degree, the health and comfort of many.

In order to best protect the interests of their clients, a large number of architects and heating and ventilating engineers are selecting Clarage Kalamazoo Multiblade Fans. Not only are the Multiblade Fans chosen because of large capacity, low speed and economy of operation, but because, above everything else, this equipment is indeed dependable. Actual installation records bear evidence of this fact.

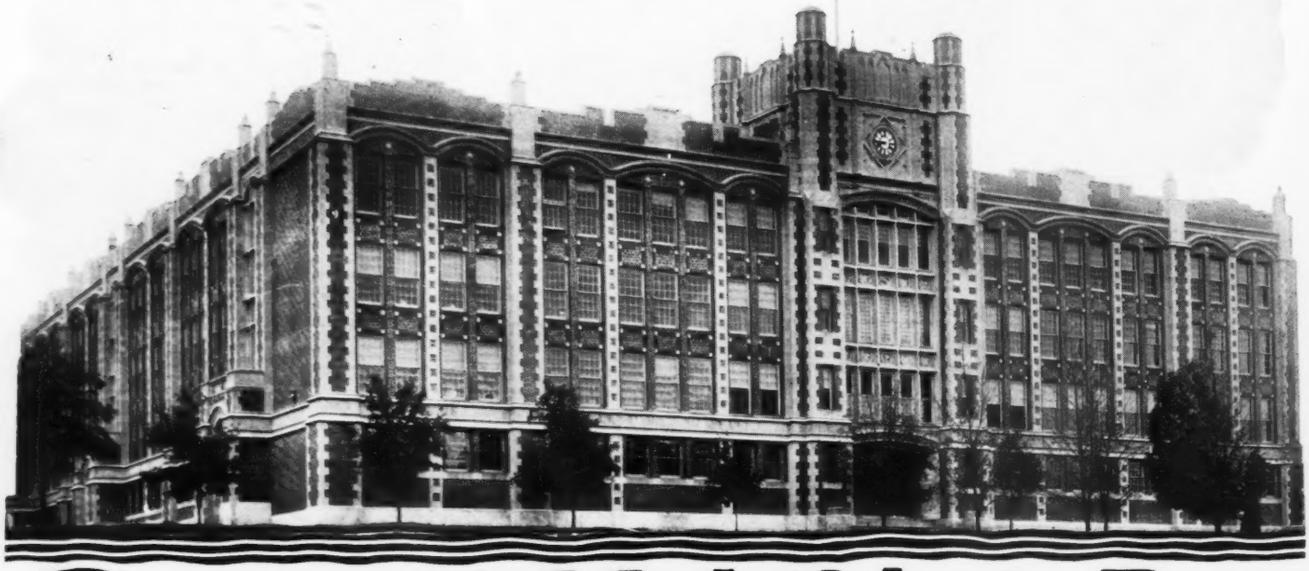
Is it not possible for you to investigate the merits of our equipment? We will be very glad to send you our latest catalog or to have a Clarage engineer call at your convenience.

CLARAGE FAN COMPANY

New York, Philadelphia, Minneapolis, Chicago, Detroit, Boston, Cleveland, Pittsburgh, St. Louis, Los Angeles, Indianapolis

Main Office and Factory, KALAMAZOO, MICHIGAN

CHICOPEE HIGH SCHOOL
CHICOPEE, MASS.
Equipped throughout with Clarage Apparatus
Architect—George E. Haynes, Pittsfield, Mass.
Heat. and Vent. Contractor—
Gavin & Moriarty, Willimansett, Mass.

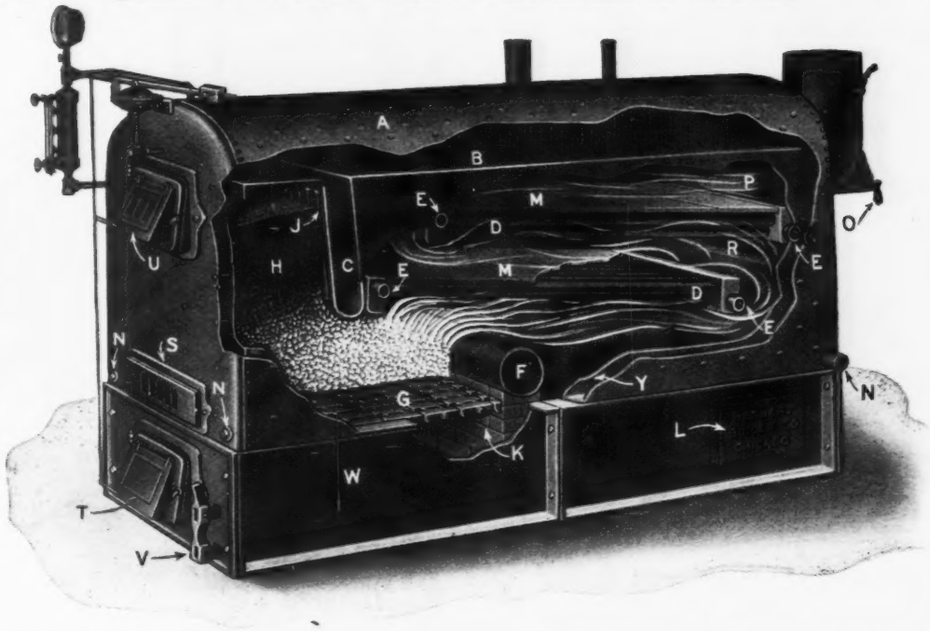


CLARAGE — KALAMAZOO Multiblade Fans

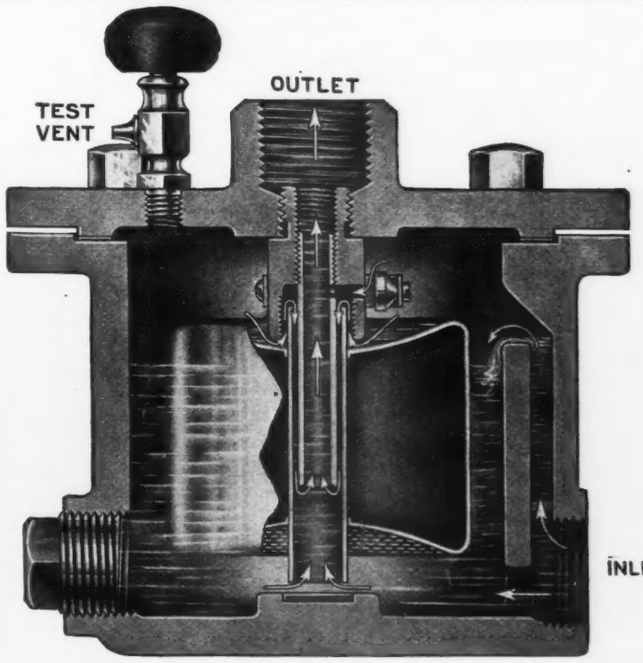
NO FLUES TO CLEAN in the HERBERT

Portable Magazine Water-tube Smokeless Boiler

A—Outside shell
B—Inside shell
C—Water tube leg that forms magazine
D—Water tube sections
E—Circulating tubes
F—Water tube bridge wall
G—Coal gate
H—Magazine section
J—Corrugated flues for passage of gas on front of water leg "C"
K—Cast iron plate that forms back of ashpit
L—Cleanout door
M—Firebrick tile
N—Washout plugs and return pipe connections
O—Check damper
P—Smoke outlet
R—Clean out
S—Clinker door
T—Ashpit door
U—Magazine door
V—Fulcrum
W—Steel base
Y—Water space



HERBERT BOILER COMPANY, Root and LaSalle Sts., Chicago, Ill.



MARSH

DUPLEX WATER SEAL LOW PRESSURE

BLAST TRAP

FOR DIRECT OR INDIRECT COILS OR ANY LOCATION WHERE LARGE QUANTITIES OF WATER ARE TO BE DISCHARGED

Operates automatically either with or without mechanical suction on return line.

No complicated parts to stick or get out of order.

No small openings to clog up with sediment or scale.

Free passage of water—rapid and steady vent of air and passes no steam.

Combined action of flotation for water and all metal thermostatic vent for air together with relief of air through water seal makes the ideal trap for heavy service.

Adjusted and tested at factory and shipped ready for installation, to work automatically from below atmosphere on up to 25 pounds steam pressure.

We Invite Correspondence

JAS. P. MARSH & CO., 118-124 South Clinton Street, Chicago

FOUNDED 1865

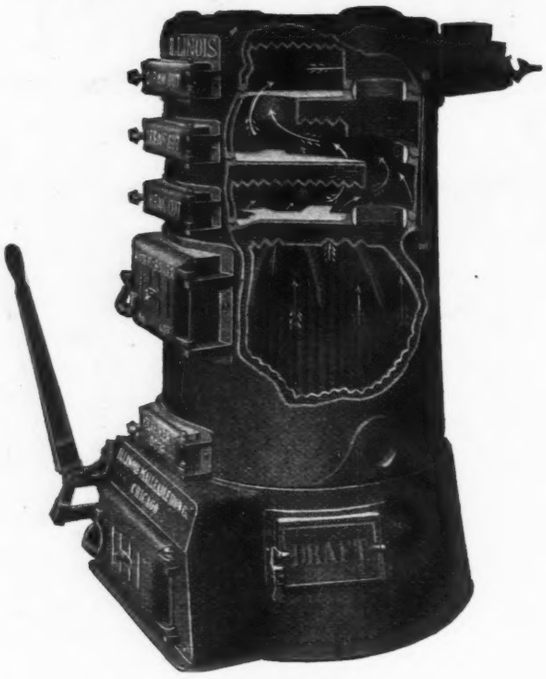
Manufacturers of Radiator Traps and Specialties—Automatic Air Valves and Vents
Indicating and Recording Gauges

Agents for Great Britain and Ireland: Chatterton & Co., 30 Fetter Lane, E. C. 4, London
Agents for Dominion of Canada: Taylor-Forbes Co., Ltd., Guelph, Ontario

IMICO HEATING BOILERS

For Water and Steam

Various Sizes



Imico Vacuum Heating System

Write For Catalogue

Manufactured by

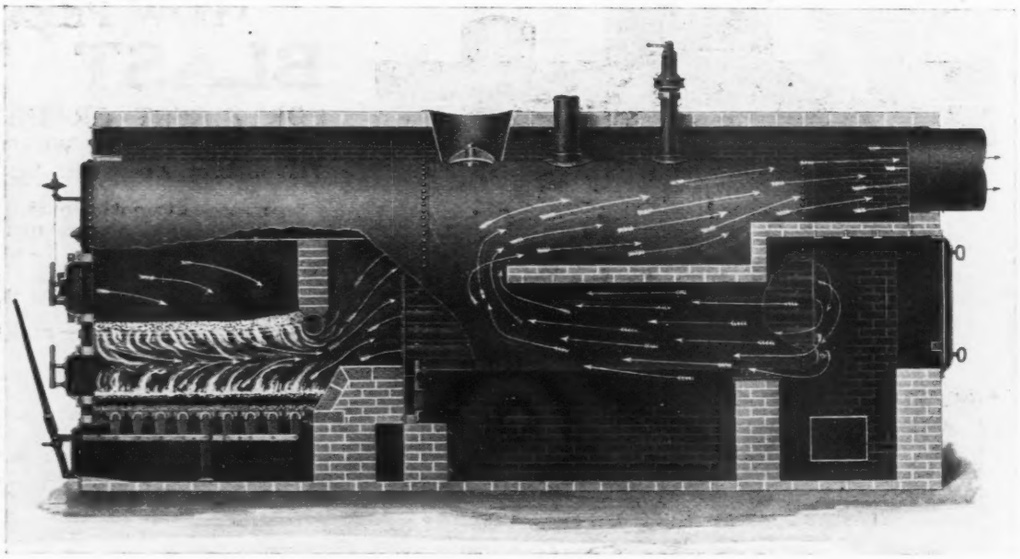
ILLINOIS MALLEABLE IRON CO. Chicago, Ill.

"Oil City" Boilers for Heating

"Oil City Boilers" will burn any kind of fuel and are constructed to the requirements of all States and to the Code of Boiler laws as adopted by the American Society of Mechanical Engineers.

Smokeless Down Draft Boilers will pass the most rigid city smoke ordinance.

Safety, Efficiency, Economy, Dependability, Durability, No Repairs, Require little attention, Conservatively rated.



OIL CITY BOILER WORKS, OIL CITY, PA.

BRANCH OFFICES:

New York, 501 Fifth Ave., Chicago, No. 1224 Marquette Building, Pittsburgh, House Building.

KEWANEE

Facts:

Do you realize that more Kewanee Boilers are used for heating big school buildings in the United States and Canada than all other makes combined? It is a fact.

Big schools are built by ***good*** Architects, and the heating systems are installed by ***good*** Heating Contractors. So such universal recognition of Kewanee quality by the leaders in their fields means much.

KEWANEE BOILER COMPANY
KEWANEE, ILLINOIS

Steel Heating Boilers, Radiators, Tanks, Water Heating Garbage Burners

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CHICAGO	Market and Washington Sts.	SALT LAKE CITY	Scott Bldg.
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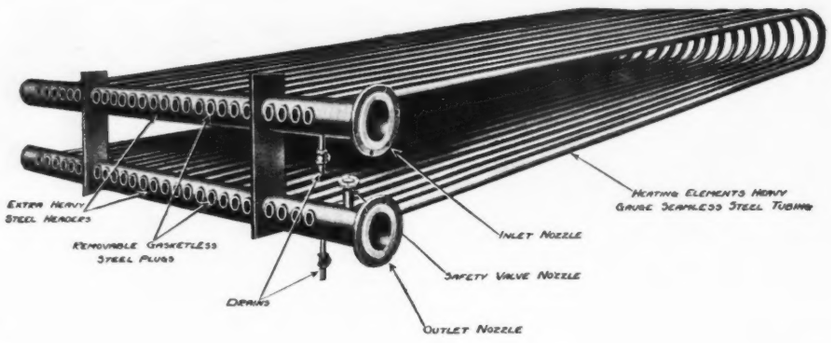
KANSAS CITY	2014 Wyandotte St.	DALLAS	Southwestern Life Bldg.
INDIANAPOLIS	509 Occidental Bldg.	DETROIT	1772 Lafayette Boul.
ST. LOUIS	1212 Chemical Bldg.	TOLEDO	1121 Nicholas Bldg.
MINNEAPOLIS	708 Builders Exchange	CLEVELAND	706 Rose Bldg.
COLUMBUS, O.	808 1st Natl. Bank Bldg.	ATLANTA, GA.	1524-25 Candler Bldg.

SAN FRANCISCO, 72 Fremont St.

CANADIAN REPRESENTATIVES—The Dominion Radiator Co., Ltd.
Toronto, Ont., Montreal, Que., Winnipeg, Man., Hamilton, Ont., St. John, N. B., Calgary, Alta.

The Whitlock All-Steel Superheater



CONSTRUCTION—headers of heavy open hearth steel with inlet and outlet nozzle VanStoned and provided with extra heavy steel flanges.

TUBE ELEMENTS—Heavy gauge seamless cold drawn steel expanded into headers.

Openings in headers opposite tube terminals are closed by patented gasketless removable steel caps.

Bulletin 30-A is just off the press--write for it

THE WHITLOCK COIL PIPE CO., Hartford, Conn.

New York Philadelphia Chicago Boston Buffalo Baltimore

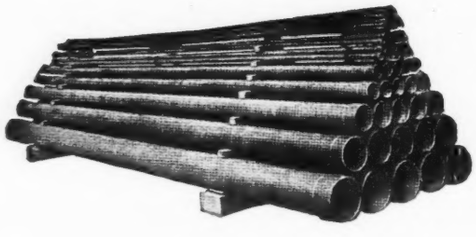
Agents in all Principal Cities

JOHN SIMMONS CO

110 Center Street, New York

IRON AND STEEL PIPE—FITTINGS—VALVES

RAILWAY
MILL
and
FACTORY SUPPLIES

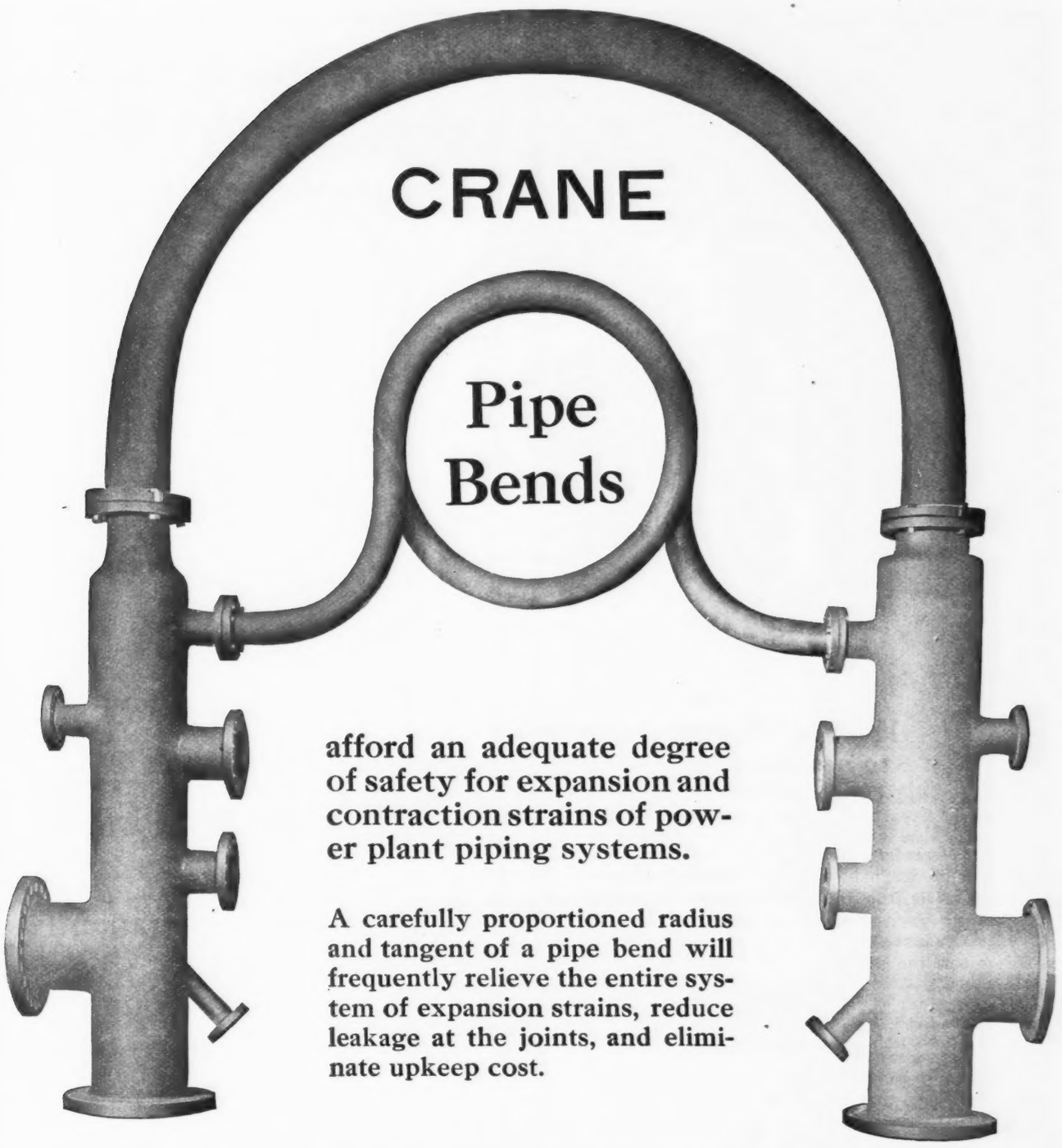


STEAM SPECIALTIES
FIRE PROTECTION
EQUIPMENT
FIRING TOOLS

Sole Distributors for this section of WM. POWELL CO.'S HIGH GRADE VALVES and DEPENDABLE ENGINEERING SPECIALTIES

PIPE COILS and BENDS — PLUMBING SUPPLIES

Special Literature Sent on Request



afford an adequate degree of safety for expansion and contraction strains of power plant piping systems.

A carefully proportioned radius and tangent of a pipe bend will frequently relieve the entire system of expansion strains, reduce leakage at the joints, and eliminate upkeep cost.

WE MAKE ALL TYPES OF BENDS FROM ANY SIZE PIPE

SALES OFFICES, WAREHOUSES AND SHOWROOMS:

BOSTON, SPRINGFIELD, HARTFORD, BRIDGEPORT, ROCHESTER, NEW YORK, HARLEM, ALBANY, BROOKLYN, PHILADELPHIA, READING, ATLANTIC CITY, NEWARK, CAMDEN, BALTIMORE, WASHINGTON, SYRACUSE, BUFFALO, SAVANNAH, ATLANTA, KNOXVILLE, BIRMINGHAM, MEMPHIS, LITTLE ROCK, MUSKOGEE, TULSA, OKLAHOMA CITY, WICHITA, ST. LOUIS, KANSAS CITY, TERRE HAUTE, CINCINNATI, INDIANAPOLIS, DETROIT, CHICAGO, ROCKFORD, OSHKOSH, GRAND RAPIDS, DAVENPORT, DES MOINES, OMAHA, SIOUX CITY, MANKATO, ST. PAUL, MINNEAPOLIS, WINONA, DULUTH, FARGO, WATERTOWN, ABERDEEN, GREAT FALLS, BILLINGS, SPOKANE, SEATTLE, TACOMA, PORTLAND, POCATELLO, SALT LAKE CITY, OGDEN, RENO, SACRAMENTO, OAKLAND, SAN FRANCISCO, LOS ANGELES

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FOUNDED BY R. T. CRANE, 1855

CRANE CO.

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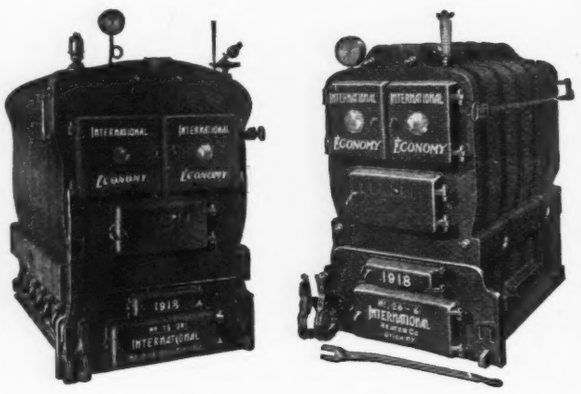
CRANE LIMITED — MONTREAL, TORONTO, VANCOUVER, WINNIPEG, CALGARY, REGINA, HALIFAX, OTTAWA

CRANE-BENNETT, LTD. — LONDON, ENG.

We are manufacturers of about 20,000 articles, including valves, pipe fittings and steam specialties, made of brass, iron, ferrosteel, cast steel and forged steel, in all sizes, for all pressures and all purposes, and are distributors through the trade of pipe, heating and plumbing materials.

ECONOMY BOILERS

"The boiler without a header"



You can't afford to use headers

In the Economy you have a boiler that delivers dry steam to the heating system without the use of header construction. A simple, yet effective, device built into the sections separates the steam from the water. So efficient is this device that, regardless of the steam velocity, less than one-half of 1% moisture will be found to pass the outlets.

—No Return Headers
—No Supply Header
—No Equalizing Loops
—No Special Connections

Just stop for a moment and figure what these cost when you supply the pipe, fittings and labor to make them.

Install the Economy–save this expense

Send for a copy of our new Boiler Catalog H-1296 which gives method of rating according to code adopted by the American Society of Heating and Ventilating Engineers and suggestions for estimating.

INTERNATIONAL HEATER COMPANY

UTICA, N. Y.

BRANCHES:

New York Chicago Greensboro, N. C. Nashua, N. H.

Guaranteed to Fix that Leaky Boiler

SHUR-TITE

(*Registered U. S. Patent Office*)

Seals quickly, permanently and economically.
Easy to use. Pour into boiler and start a fire—that's all.

The World's Best BOILER CEMENT

Order from your jobber

The Shur-Tite Manufacturing Co.

1240 West Fourth St. CLEVELAND, OHIO

Some good territory open for capable representatives

At Last!

A SINGLE PIPE VAPOR SYSTEM

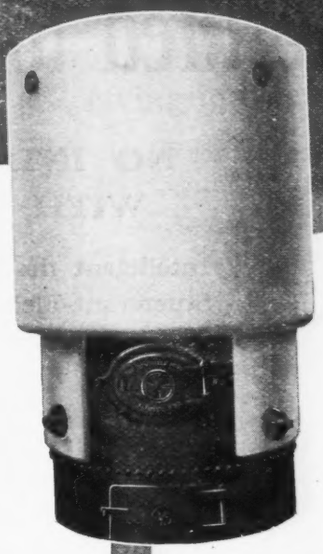
Simple to Install
Efficient in Operation
Low in Cost

Descriptive Matter sent on request

GORTON & LIDGERWOOD CO.
96 Liberty Street
New York

FISHER BUILDING, CHICAGO, ILLINOIS

TITUSVILLE JACKETED TUBELESS WATER HEATER



For Heating Domestic Hot Water by Direct Circulation

This illustration shows a heater covered with asbestos ready for operation—particularly adapted to high buildings or places where the water pressure is excessive and cast iron heaters cannot be used.

This heater is constructed entirely of steel—is extremely heavy throughout and provided with a heavy removable jacket with baffles and cleanout doors—designed and especially recommended for the severe service of heating domestic hot water by direct circulation—the TITUSVILLE Jacketed Tubeless Water Heater may be installed with absolute confidence that your water will be well heated at a fair cost of operation with a minimum expense for repairs.

OUR CATALOGUE
giving further details and description will be gladly sent to letter-head requests.

THE TITUSVILLE IRON WORKS CO.
TITUSVILLE, PA.

Climate
Manufactured to suit your Product

NO INTERFERENCE WITH LIGHTING

Intelligent design of Air Ducts in Sturtevant-Fleisher Air Conditioning Systems prevents any interference with the Lighting of the plant.

A frequent objection voiced by many mill and factory owners in regard to Air Conditioning Systems is the probability that the Air Ducts would seriously interfere with the lighting of the plant.

Following the Sturtevant-Fleisher policy of complete engineering investigation and careful design, we have succeeded in eliminating all interference with the lighting of the mill without, in any way, impairing the efficiency of the Air Conditioning System.

Our Guarantee of satisfactory operation is written into all contracts, whether it is requested or not. This Guarantee is based on the 60 years' engineering and manufacturing experience of the Sturtevant and Fleisher Companies.

B. F. Sturtevant Co.
Hyde Park - - - Boston

W. L. FLEISHER & CO., Inc.
New York City
Design and install all Sturtevant-Fleisher Air Conditioning Systems

Sturtevant
PUTS AIR TO WORK

OZONE PURE AIRIFIER

The installation of the "Ozone Pure Airifier" in connection with Fan systems of heating and ventilation in schools, theaters, banks and manufacturing plants, permits of re-circulation of a large percentage of the total air volume handled.

ADVANTAGES

Saving in Cost of Operation

1.—Reduction of 25 to 50% in coal consumption.

2.—Reduction in Steam Consumption.

Saving in initial Cost of Mechanical Equipment.

1.—Tempering coils may be omitted.

2.—Boiler capacity may be reduced.

3.—Sizes of steam and return pipes, valves, fittings and pumps may be reduced.

RESULTS

Pure air in rooms, free from organic odors and impurities.

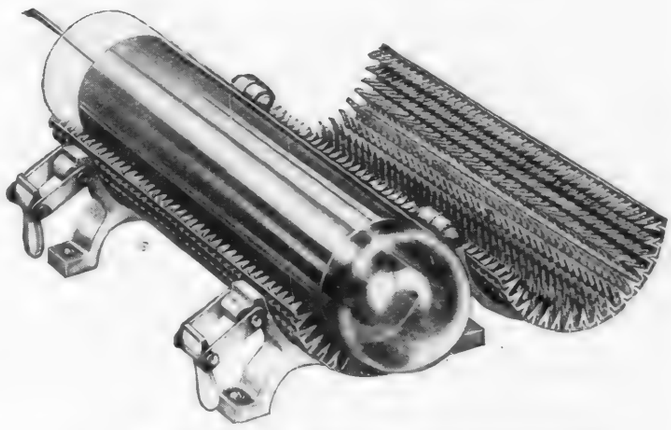
The power consumed by the apparatus is extremely small, being only about 120 watts maximum for a 25,000 cu. ft. (per minute) machine when operating on alternating current. Based on an energy cost of 10c per kw. hr., this would give a cost of 12c per 10-hour day.

We will be pleased to send literature on this subject to anyone interested,

Ozone Pure Airifier Co.

1403 W. Jackson Blvd.

CHICAGO, ILL.



One complete unit capable of properly ozonizing 1000 cu. ft. of air per minute. The unit is shown open to illustrate simplicity of construction and ease of cleaning.

"O-E Perfect Packless Graduated Valve. Placed at top of Radiator. Quick opening. Never sticks. Tested by Air and Water tests.

Simplicity in a Heating System Is Twin Brother to Common Sense

The basic principle of the "O-E" Perfect Vapor-Vacuum-Pressure Heating System is simplicity. There are no floats, return traps, pumps, diaphragms or other complicated parts to get out of order. Eliminates automatic air valves.

Three Systems in One

Vacuum most of the time, Vapor part of the time, Pressure when desired. A great coal-saver. Always holds steady water line. Most adaptable, flexible and efficient of any. Noiseless in operation. Practically fool-proof. No expert attention needed.

"O-E" Perfect Air Exhauster and Vacuum Valve, with new Hollow Bronze Ball. Always works. Never sticks. Carefully tested.

The "O-E" System costs less to install and gives your customer better service than either vapor or water. Is easier to install right than wrong.

Before deciding on the heating equipment for your next job, investigate the "O-E" Perfect System. It will save you labor and material costs, unprofitable call-backs for adjustments and repairs, and our guarantee furnished with each installation fully protects you.

"O-E" Perfect Ball Check Water Seal Return Fitting, with Air Vent and Clean Out. Each Fitting carefully tested.

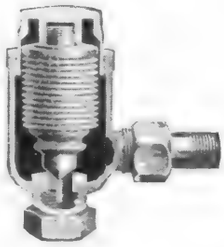
Write for Booklet "A"

O-E SPECIALITY MANUFACTURING CO.

882 THIRD ST., MILWAUKEE, WIS., U. S. A.

QUALITY SERVICE QUALITY

Heating Specialties that Last

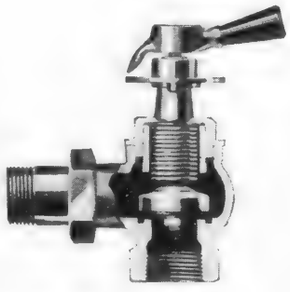


The B & B Line

In specifying the B. & B. Line of Heating Specialties for vacuum systems and Temperature Control Systems you are assured of getting QUALITY-SERVICE and a Heating Specialty that will last.

The B. & B. Multiflex Trap and B. & B. Multiflex Modulation Valve, as illustrated, are metal throughout and contain a B. & B. Multiflex Wonder Bellows. Note the simplicity in construction of the Multiflex Modulation Valve.

Literature sent upon request.



- B. & B. Vacu-Vapor System
- B. & B. Return Line System
- B. & B. Air Line System
- B. & B. Temperature Control System
- B. & B. High Pressure Specialties

THE BISHOP & BABCOCK COMPANY

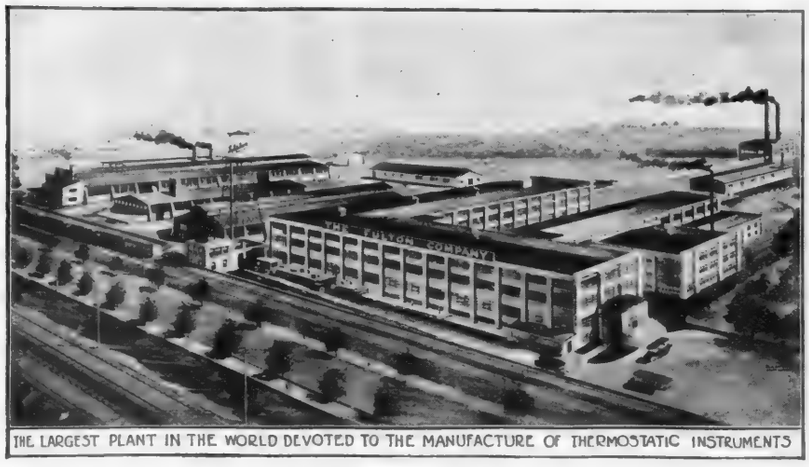
General Offices and Factories, CLEVELAND, OHIO

Announcement

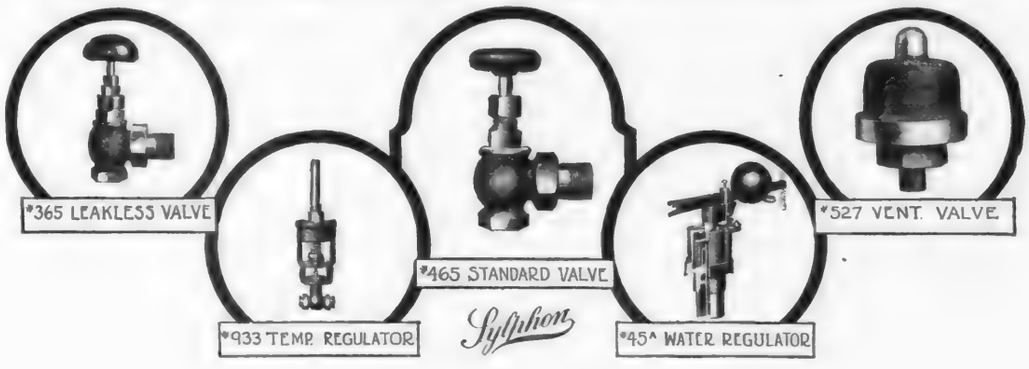
SYLPHON SPECIALTIES

Sold for years through the American Radiator Co.

Can Now Be Bought Direct From Manufacturer



THE LARGEST PLANT IN THE WORLD DEVOTED TO THE MANUFACTURE OF THERMOSTATIC INSTRUMENTS



PRICES REDUCED

OUR NEW POLICY of distributing Sylphon Heating Specialties means lower prices. We are now building our own sales organization, with direct factory-trained representatives co-operating with the jobber and the trade.

You can now supply your customers with these specialties at prices no higher than less efficient instruments of various types—and with equal or better profit to yourself.

Send to Dept. W for new discount sheet.

THE FULTON COMPANY, Knoxville, Tenn.

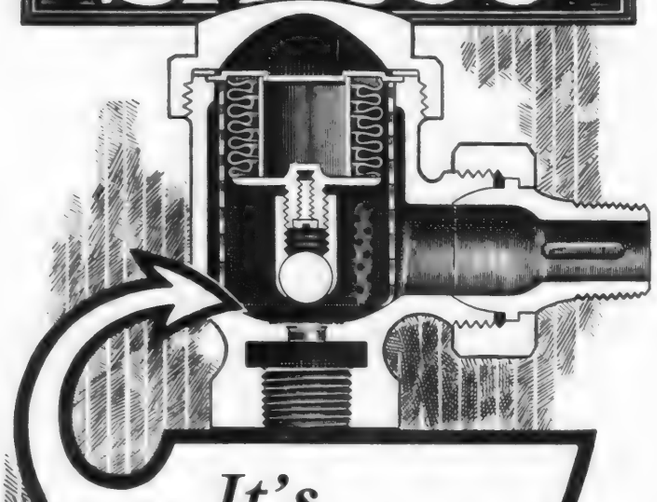
Representatives in all the larger centers

NEW YORK
Hudson Terminal Bldg.
50 Church St.

DETROIT
Book Bldg.
Washington Blvd.

CHICAGO
Wrigley Bldg.
400 N. Michigan Ave.

Radiator Trap SARCO



It's Practical

If we were allowed only one word with which to describe the Radiator Trap Sarco we would choose the word "Practical."

The general run of radiator traps are so "temperamental," so constantly getting out of order, that a practical trap is given instant recognition by the heating expert.

That is why the Sarco commands favorable notice wherever installed—it gives a good account of itself in actual service! It's Practical.

Adjusted properly at the factory, the Sarco requires no adjustment at the time of installation. From the very first day it functions properly, and continues to do so indefinitely.

The positive closing action, which insures a tight valve—the wide-open valve-lift, providing free discharge—the large strainer, which protects the valve-seat from scale—and the spirally corrugated expansion element, which practically eliminates wear—all these are features which recommend the Sarco to the discriminating engineer.

Made for vacuum, vapor and steam heating systems up to 20-pound pressure.

Our Booklet P-104 tells the complete story in an easy-to-get style. Write for a copy TODAY.

SARCO CO., Inc.

231 Broadway New York City

Buffalo Chicago Cleveland
Detroit Philadelphia

Cut Down Repair Bills

Ninety per cent of the repair bills and replacements on return line pumps are caused by the corrosive action of hot water on the working parts of the pump.

Brass linings and similar protection only partially solve the problem. The only real solution is the DuMoin principle—to stop pumping hot water altogether.

Thompson's DuMoin Vacuum Return Line Pump

is built on an entirely new principle. It draws the hot condensation water back into a tank by creating a vacuum on the tank. Then it automatically reverses, puts the tank under pressure, and forces the water back into the boiler.

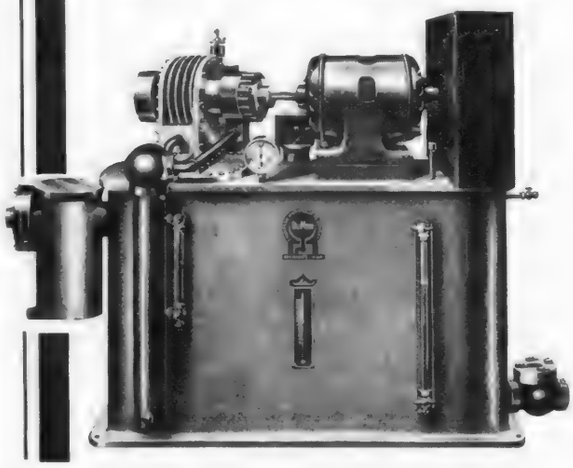
No hot water touches the pump. There is no corrosion; no frequent repair bills; no constant trouble and expense. The life of the pump is increased to five or ten years on ordinary jobs.

Every operation is automatically controlled. Pump works only when actually needed—which is about 25% of the time. Just half the power required by the ordinary standard systems now in use is required.

Investigate. Write today for Bulletin 6—with full explanation, specifications and prices.

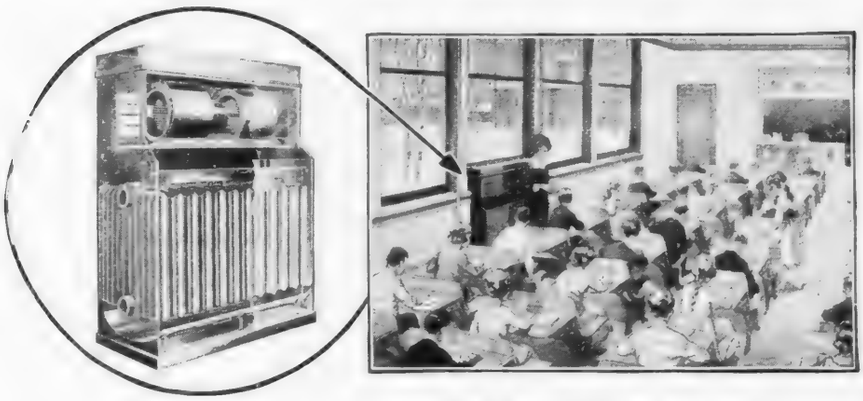
Thompson Mfg. Co.

813 24th St. Des Moines, Iowa



UNIVENT

"LIVE OUTDOORS-INDOORS"
(TRADE MARK)



Phantom view *Fresh heated air from the window*

Your Ideal of Ventilation Realized

Your ideal of perfect ventilation is all the fresh air you want, when you want it, where you want it.

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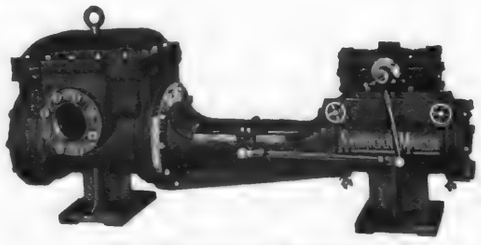

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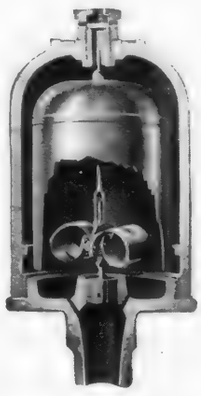

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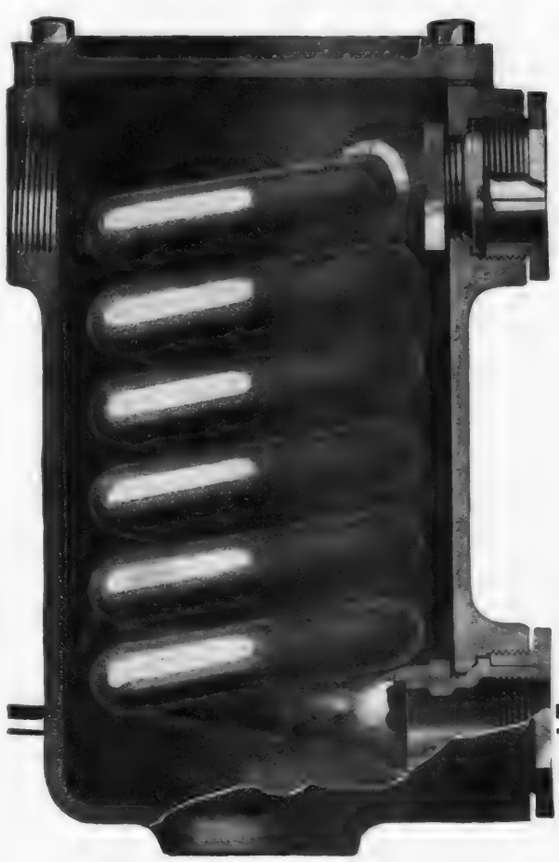

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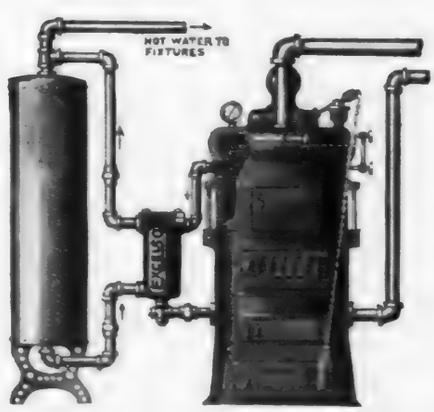

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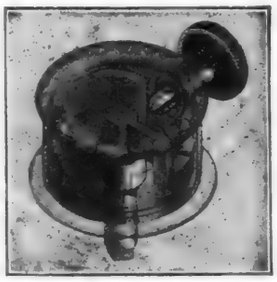

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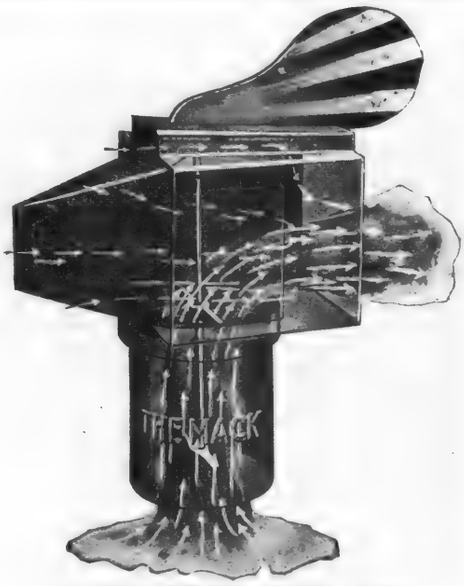

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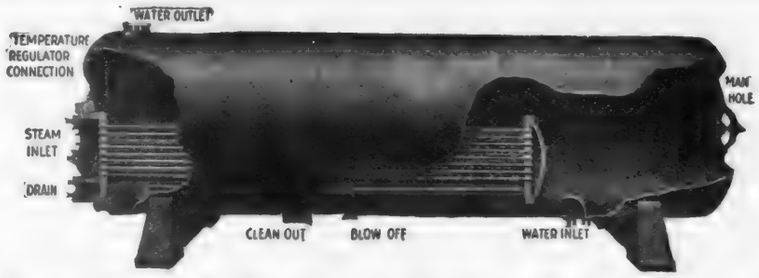

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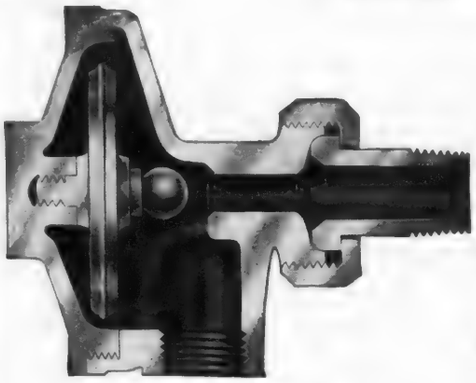

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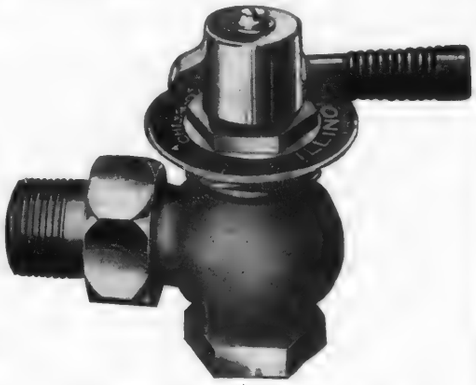

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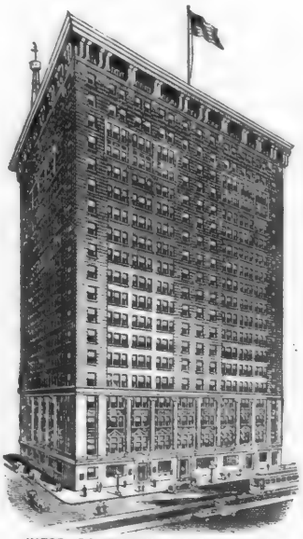

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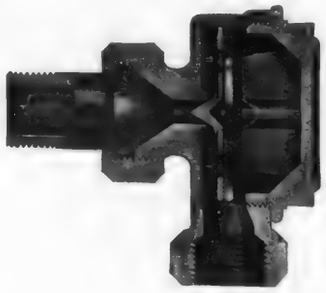

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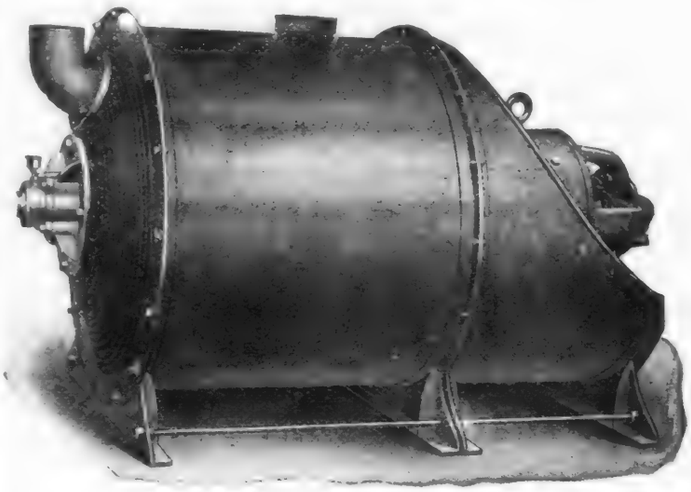

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MARCH, 1922

HEAT AS A MEANS OF DESTROYING MILL INSECT PESTS

With Data on Temperature to Be Maintained, Method of Installing Heating Systems and Suggestions for Operation

BY J. P. CALDERWOOD,
Professor of Mechanical Engineering, Kansas State Agricultural College.

THE loss in dollars and cents that results from the insect pests which infest stored grains and flour mill products is difficult to estimate. Statistics show that for individual cases the percentage loss in grain is high and it is safe to say that the total loss in the United States would reach millions of dollars.

The flour milling industry appreciates, more fully than any other, the extent of this loss and is convinced that insect infestation is one of its important problems. The industry not only experiences a loss in grain destroyed, but is further annoyed by the accumulation of web in the machines and spouts, the destroying of bolting cloth, and other injurious results. The industry has used the means that have been suggested in the past for exterminating insect life, but the great difficulty was the lack of an effective method.

USE OF HYDROCYANIC ACID GAS FUMIGATION.

Up to the time of the discovery of the heat method, hydrocyanic acid gas fumigation was considered the most effective means for the control of mill insects. The hydrocyanic acid method is still used as a means of ridding mills of insect life, but is gradually falling into disfavor. Experiments now show that while most insects succumb to the gas, others that are by nature equally destructive and annoying are not seriously affected.

Furthermore, the method is dangerous—hydrocyanic acid gas is one of the most powerful and poisonous gases. Another handicap to the method is the relatively high cost of the fumigation. Several additional objections might be mentioned, but they are of minor importance.

DESTROYING MILL INSECTS WITH HEAT A NEW DEVELOPMENT.

Heat as a method of destroying mill insects is comparatively new. Its killing effect upon bug life in general has been known for some time, although the application of this principle to flour mills and other milling industries has but recently been developed. Impetus was given to this method in connection with mills that were infected with insects that are found in cracks and inaccessible places. Under such conditions, something more effective is necessary. Heat seemed to have possibilities and was tried. As a result it may be safely said that the application of high temperature is the only practical and efficient method known at present for completely controlling all classes of mill-infecting insects.

PROPER TEMPERATURE TO BE MAINTAINED TO KILL INSECT LIFE.

Laboratory experiments to determine the fatal temperatures when the heat is applied under slowly rising temperatures that could be duplicated in mills show that a temperature of 125° F., if continued for several hours, is sufficient to kill all the prevalent types of mill insects.

The result of these laboratory investigations have been verified in actual mill tests. Experiments in the milling industry show that the insects can be destroyed at a temperature not beyond that which could actually be produced in a modern mill. In tests conducted by the Experiment Station of the Kansas State Agricultural College, the system has shown itself very effective. In the test of one mill, heat was applied for twenty-four hours on a day in September. The mill was equipped with the ordinary direct steam system. The temperature on the various floors of the mill gradually rose to an average of about 130° F. After the heating a very careful examination failed to show live insects even in the deepest accumulations in the most inaccessible parts. Nearly three weeks later a second examination was made of the mill, and no live insects were found above the first story.

The following summer the same mill was again heated. A few months later, a thorough examination was made of the mill and failed to reveal a live insect, except in one corner on the first floor where a few second-hand sacks had been thrown after the mill had been heated. The examination also showed that no part of the mill had been injured during the heating process.

NEW FIELD OPENED TO HEATING AND VENTILATING ENGINEERS.

Heat as a means of controlling mill insects should be of interest to heating and ventilating engineers for few mills have sufficient heating equipment installed to produce killing temperatures. In most cases, millers appreciate the effectiveness of the method and require little persuasion in making the necessary changes. The strong argument that may be advanced is that a heating system once installed is good for years, and that the cost of a heat application to destroy insects is small. The cost

of only a few applications of cyanide fumigation would in most cases pay for the necessary changes in the heating system.

AMOUNT OF RADIATION NEEDED.

The amount of radiation required to produce the required temperature of 125° depends, naturally, upon the type of building, its construction, the number of windows and doors, and other factors. Each case should receive separate treatment. A mill, however, that has sufficient radiation to heat the building to 70° in zero weather without the heat of the running machinery can readily be heated to 130° F. on a warm summer day. It is true that flour mills in general are of much the same type; consequently, an approximate rule may be used in estimating the amount of radiation required. One rule that seems to give accurate results is given in table 1.

Table 1. Cubic Feet of Space One Square Foot of Radiation will heat:

	FOUR-STORY MILL	FIVE-STORY MILL.
First Floor	50	50
Second Floor	60	60
Third Floor	75	75
Fourth Floor	100	90
Fifth Floor		110

SUGGESTIONS FOR INSTALLING HEATING SYSTEM.

In installing a steam system of heating several important suggestions should be observed.

1. Pipe-coil radiation is usually the cheapest, occupies the least floor space, and will stand high pressures. The coils are made up preferably of 1¼-in. pipe and U-bends, connected upon a two-pipe system to the flow and return mains.

2. It is preferable to install valves at each radiator so that the temperature of the rooms may be regulated during the heating.

3. The radiation should be distributed uniformly about the room to be heated and placed near the floor level to insure a uniform distribution of heat.

4. No radiation is needed, as a rule, in the basement; the insects prefer the upper floors. In case boots extend into the basement, provision should be made for heating these by placing a radiator directly beneath.

5. The lower floors and the floors with heavy machinery should have more radiating surface per cubic foot of space heated than the upper floors and the floors with light machinery.

6. It does not seem advisable to decrease the amount of radiation when high-pressure steam is available. It is better to estimate the radiation upon a low-pressure steam basis, using the additional heat transmitted when using high-pressure steam to heat the building rapidly.

SUGGESTIONS FOR OPERATING HEATING SYSTEMS.

In giving directions to operators of such systems, it would be well for the heating engineer to emphasize the following points:

1. In order that advantage may be taken of the heat in the machinery, the heating should be started immediately after the mill is shut down. It is usually customary to start the heat on Saturday night and continue until sometime near Monday morning.

2. Two applications of heat during the summer months are advisable; one in the early summer, and one in August or September.

3. The steam should be turned on at a high pressure, if possible, so that the mill will heat more rapidly.

4. Stairways, elevator shafts, and spouts leading to ventilators should be closed with burlap or some other suitable material so that each floor is entirely separated and no heat unnecessarily lost.

5. It takes time to reach the desired temperature.

6. A uniform temperature of from 120° to 125° F. is sufficient to kill the insects in any part of the mill.

7. The killing temperature should be held for several hours to allow the heat to penetrate all infested parts.

8. Two or three thermometers should be placed on the different floors as a guide in regulating the temperatures. Temperatures as high as 150° F. have been carried in mills without injury, although this practice is unnecessary.

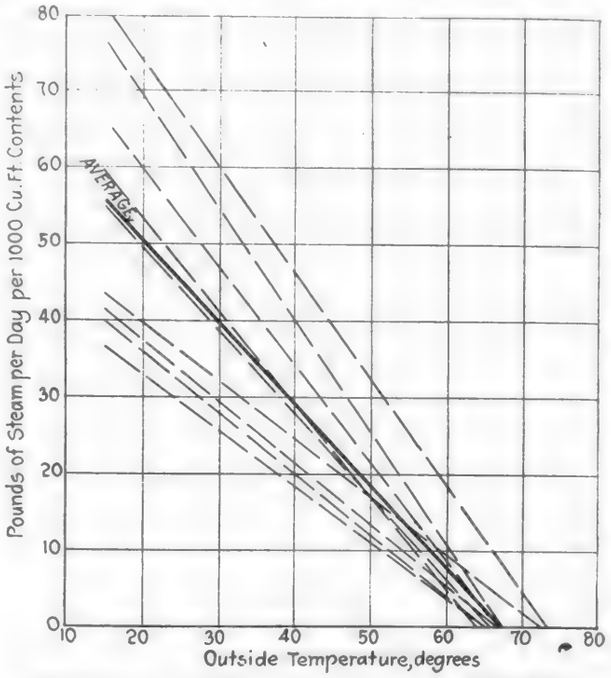
9. No attempts should be made to heat the mill on a windy, a cold or a rainy day. Conditions should be favorable for reaching the 125° F. temperature. Unless this temperature is reached, the killing effect is doubtful.

10. Cleanliness is a necessity in insect control and while heat is extremely effective in destroying insects, cleanliness should not be slighted.

How Much Steam is Required to Heat a Building?

Some interesting figures on steam consumption for heating office buildings have been obtained by the Heat Utilization Committee of the National District Heating Association and are published in the association's *Bulletin*, together with the accompanying chart.

"In order to know how much a building manager can cut down his heating expense," states the committee, "he should determine first what his standard or proper consumption is.



RESULTS OF TESTS SHOWING STEAM REQUIRED TO HEAT BUILDINGS.

This, of course, will vary somewhat with the type of construction, exposure and design of system, but relatively these points are much less important than the care with which the building is operated."

The curves compiled by the committee show the results obtained from five office buildings for two seasons. Construction of all buildings, it is stated, is similar, although they vary somewhat in size. The size, however, does not seem to have much effect on the steam consumption per cubic foot of contents. It is pointed out, for instance how wide a variation in consumption there is at 20° F., the maximum being more than 225% of the minimum, while the shut-off temperature varies from 63° to 73°. For an average winter temperature of 35°, and with steam at $1.00 per 1000 lbs., the difference in heating cost between the maximum and minimum shown on the chart will be $7,890 for a building containing 1,000,000 cu. ft.

To obtain the best results from a system, the Heat Utilization Committee recommends that the building manager should first see that his present system is in good repair. Next he should use common sense in operating it. The committee then gives a number of rules for the guidance of the building manager.

PANTAGES THEATRE BUILDING, LOS ANGELES, CAL.

MECHANICAL EQUIPMENT FOR A COMBINED THEATRE AND OFFICE BUILDING

Principal Features of the Installation in the Pantages Theatre, Los Angeles, Cal.

BY ERWIN L. WEBER.

THE underlying motive in the design of the equipment for the Pantages Theatre and Office Building, in Los Angeles, Cal., is a deviation from the usual practice of having conspicuously-arranged apparatus, pipes, lights, etc., and achieving the desired results by concealing such features as much as possible and in this way thoroughly blending with the aesthetic design of the building, and not rendering a well-schemed interior distasteful by the presence of clumsy pipes or other features.

The power requirements for the theatre include the following motors: Blower, 40 H.P.; air washer, 10 H.P.; vacuum pump, 7½ H.P.; vacuum cleaner, 7½ H.P.; six exhaust fans, 16 H. P.; organ blower, 7½ H.P.

The power for the office building (exclusive of stores or offices) include: Two elevators at 60 H.P. each; air compressor, 7½ H.P.; circulating pump, 5 H.P.; vacuum cleaner, 7½ H.P.; toilet exhaust fan, 5 H.P.

This shows a power consumption of about 250 H.P. in almost continuous operation. The total current consumption for all lights is about 400 K.W.

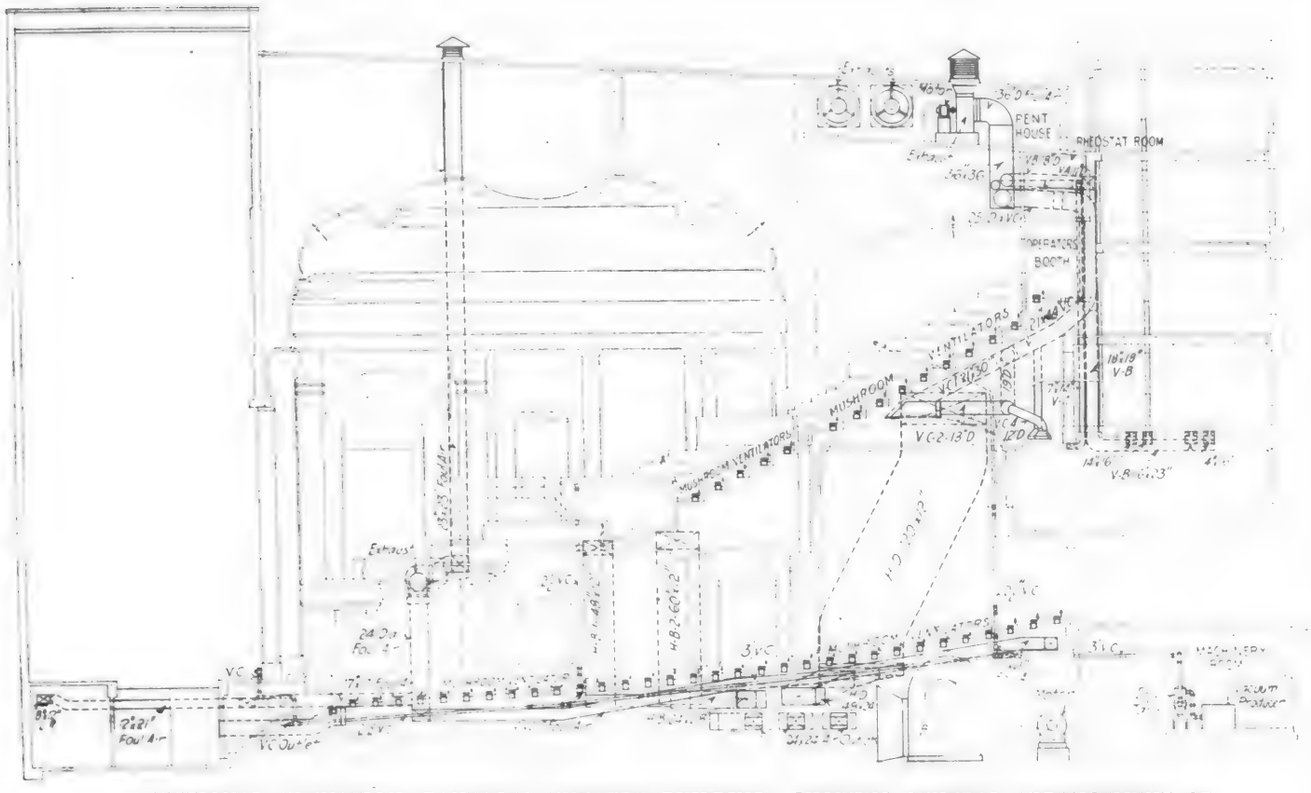
The theatre is heated and ventilated by the mushroom system. Air enters under the seats in the auditorium and balcony through nearly 1,000 mushrooms and is exhausted to the attic space through the plaster grillages in the ceiling. The vitiated air is removed from the attic by four exhaust fans located in pent houses. A separate exhaust system of ventilation is provided for the mezzanine floor and another exhaust system for the retiring rooms, toilets, dressing rooms, animal room and stage.

Fresh air is drawn through an intake shaft located in the courtway and is tempered by passing over two stacks of tempering coils containing 1358 sq. ft. of Vento and one stack of condensation coils containing 679 sq. ft. of Vento. The condensation coils receive the discharge from the vacuum pump and are used to cool the return condensation.

After passing through the condensation coils the return condensation is further cooled by passing through a Sims BH-4 30-in. by 72 in. condensation tank. The cold water in this tank is thereby warmed and used as the supply for the domestic water heater. This allows the condensation to pass to the meter and sewer at a very low temperature and assures the extraction of the maximum amount of heat from the steam.

The air next passes through a Sturtevant type H air washer 14 ft. wide by 12 ft. high, operated with a 5 in. centrifugal pump direct-connected to a 10 H.P. motor. Then the air enters the main blower which is a No. 15 Sturtevant multivane type, direct-connected to a 40 H.P. motor with armature and field speed-control. From the blower the air is discharged over two stacks of reheating coils containing 1358 sq. ft. of Vento. The conditioned air then passes to the sub-auditorium and sub-balcony through the mushroom ventilators.

About 2500 cu. ft. of air per minute is further heated in a superheating coil containing two stacks with 129 sq. ft. of Vento and is discharged in a warm blast across the main entrance to mingle with incoming cold air when the doors are opened. The air supplied to the dressing room section is also superheated by 54 sq. ft. of 3-col. radiation.



SECTIONAL ELEVATION, PANTAGES THEATRE BUILDING, SHOWING GENERAL ARRANGEMENT OF HEATING AND VENTILATING APPARATUS.

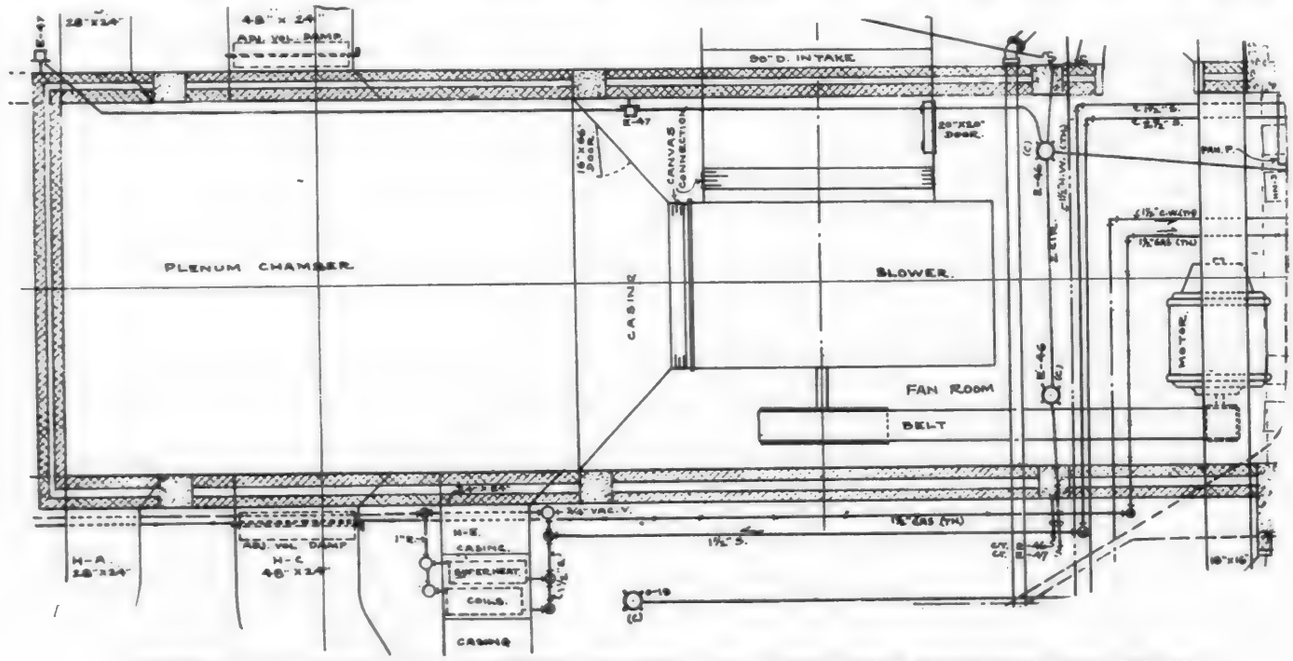
The capacity of the ventilating plant is about 80,000 cu. ft. of air per minute, or nearly 40 cu. ft. per capita per minute. A Johnson system of thermostatic control maintains a temperature of 66° F. with about 70% humidity in mild and cold weather. The air washer is provided with a large concrete tank, ice chute, ice door and the necessary protection around the strainer to permit of feeding ice thereinto in hot and humid weather.

OUTSIDE STEAM SUPPLY.

Steam at 80 lbs. pressure is provided by the Seventh Street Improvement Co. and enters the building at Seventh Street. It is passed through a reducing pressure valve and then to the tempering and reheating coils and to the domestic water heater. The condensation passes through vacuum traps to a motor-driven vacuum pump and is discharged through the condensation coils and condensation tank to the meter and sewer. About 5,000 lbs. of steam are used per hour in cold weather.

WATER HEATING SYSTEM USED FOR OFFICE BUILDING.

The warming of the office building is accomplished by a forced water heating system. Under each window a radiator is suspended from the wall and entirely free from the floor.

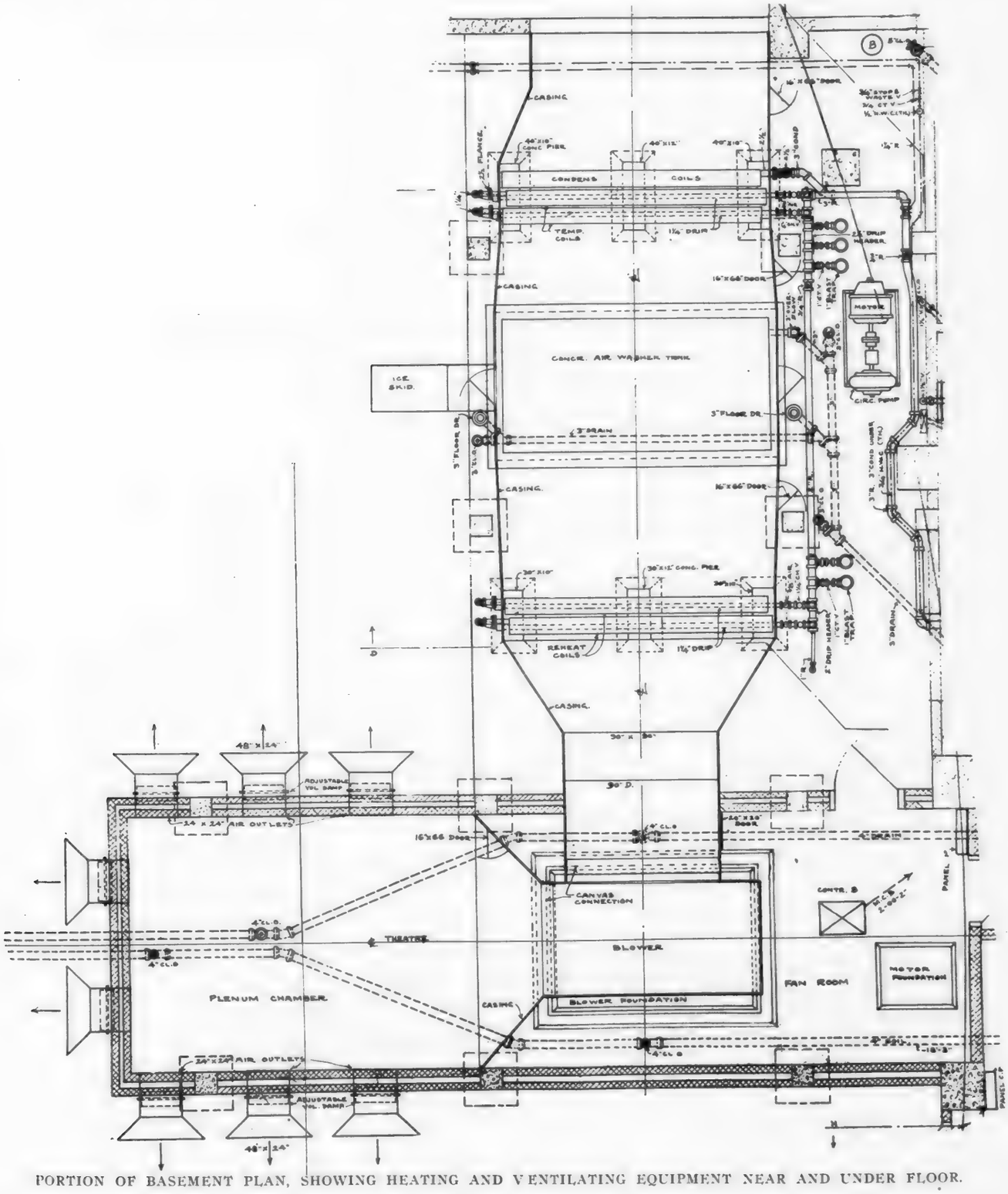


PORTION OF BASEMENT PLAN, SHOWING HEATING AND VENTILATING EQUIPMENT NEAR CEILING.

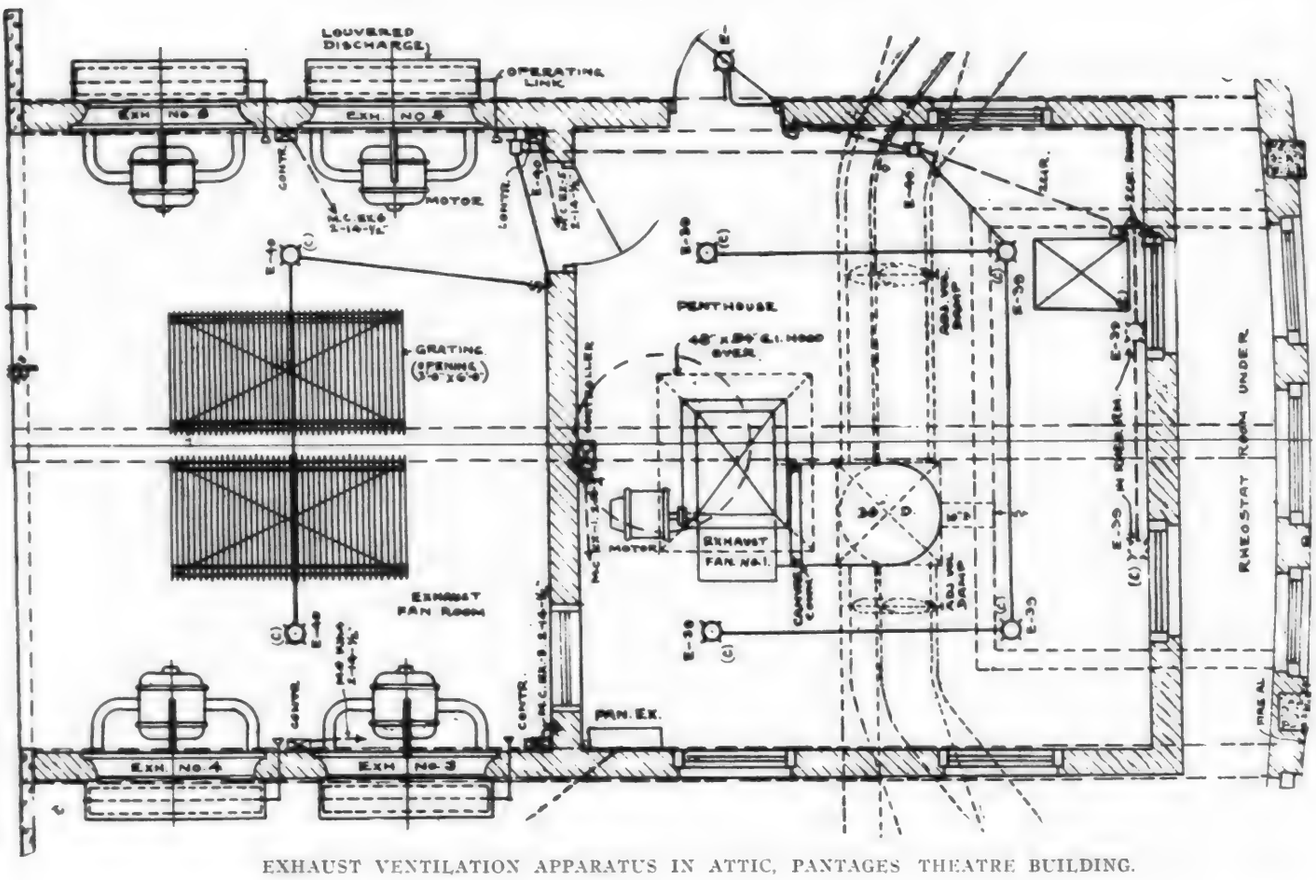
The method of connecting the radiators is a complete departure from the usual schemes, insofar as the pipes and branches are entirely concealed behind walls and window stools and the only visible connections to the radiators consist of two nickel-plated elbows emerging from the apron of the window and connecting to the radiator.

All radiators are single column, 20-in. high. By locating a radiator under each window it is possible to subdivide offices into units as desired. The radiation is estimated on a basis of 35° F. outdoor temperature with 70° indoor temperature. The average temperature of water is 190° F. The building is nine stories high and no trouble has been experienced through leakage due to the static water pressure. Alternate tenders upon a two-pipe vacuum system with reduced radiation and pipes exposed in the usual manner showed a saving of 12% in favor of the water heating system.

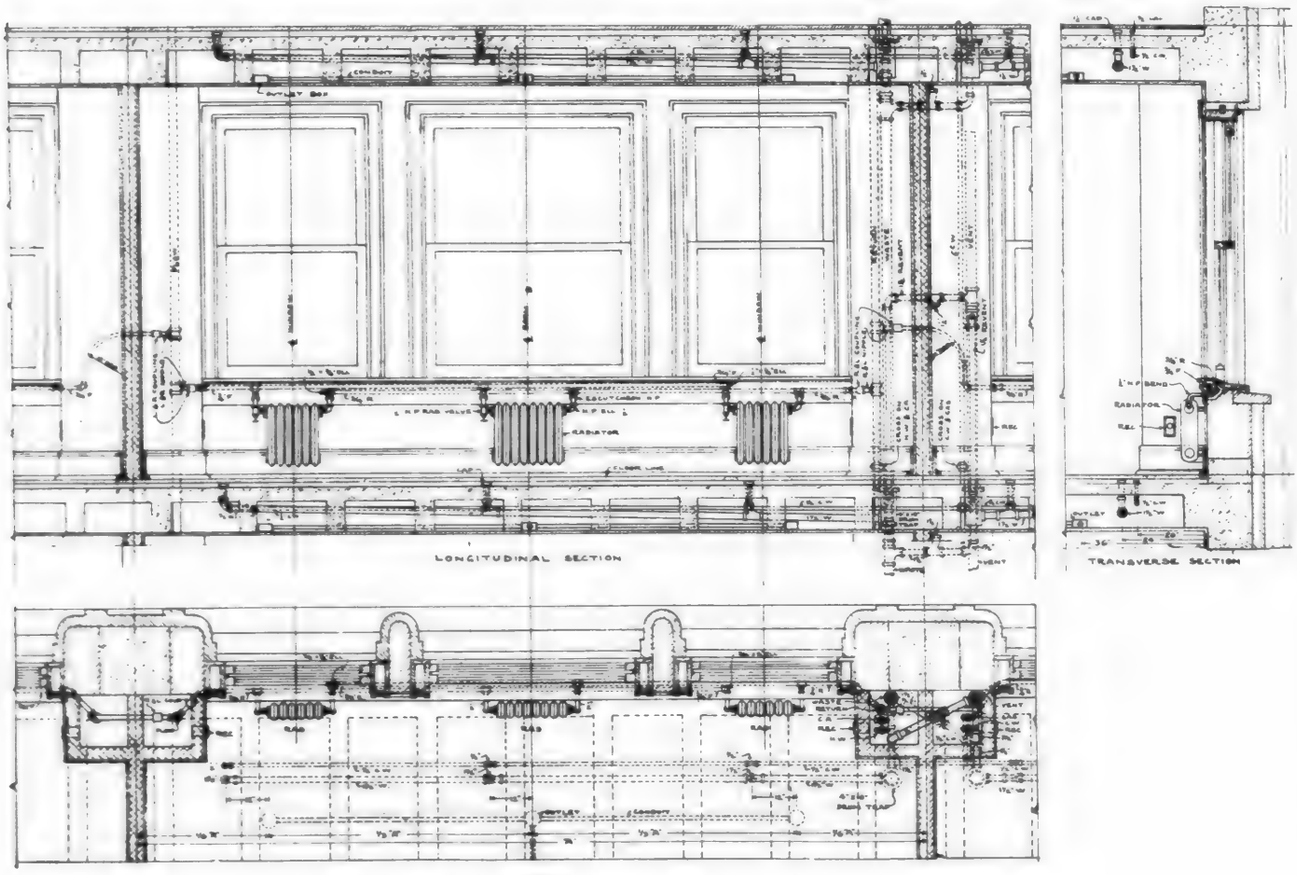
Steam at 80 lbs. pressure enters the converter wherein the water used for heating the building is warmed to any desired degree, depending upon the outdoor temperature and wind. The hot water passes to the attic where it is distributed to the various flow risers, then passes through the radiators to the return risers, which assemble in the basement and connect to a motor-driven circulating pump, from where it is discharged into the convertor, completing its circuit. All air



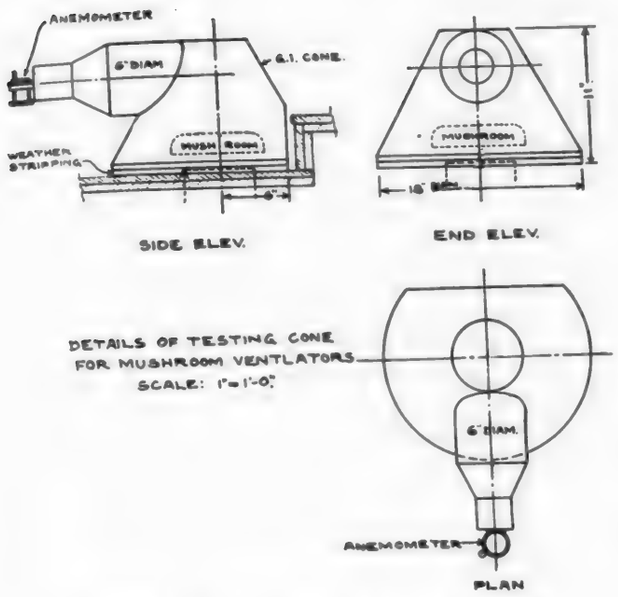
PORTION OF BASEMENT PLAN, SHOWING HEATING AND VENTILATING EQUIPMENT NEAR AND UNDER FLOOR.



EXHAUST VENTILATION APPARATUS IN ATTIC, PANTAGES THEATRE BUILDING.



DETAILS OF TYPICAL OFFICE UNIT, PANTAGES THEATRE BUILDING.



DETAILS OF TESTING CONE FOR MUSHROOM VENTILATORS.

from the radiators discharges into the flow and return risers. At the top of each return riser a 3/8-in. air line is connected to the flow main in the attic. In this way all air is relieved to the expansion tank, located in the attic. This eliminates all air binding, hissing or chattering in the system.

The convertor has a heat transfer capacity of 1,800,000 B. T. U. per hour. The circulating pump has a 3-in. discharge and is direct-connected to a 5 H.P. motor running at 1200 R. P. M.

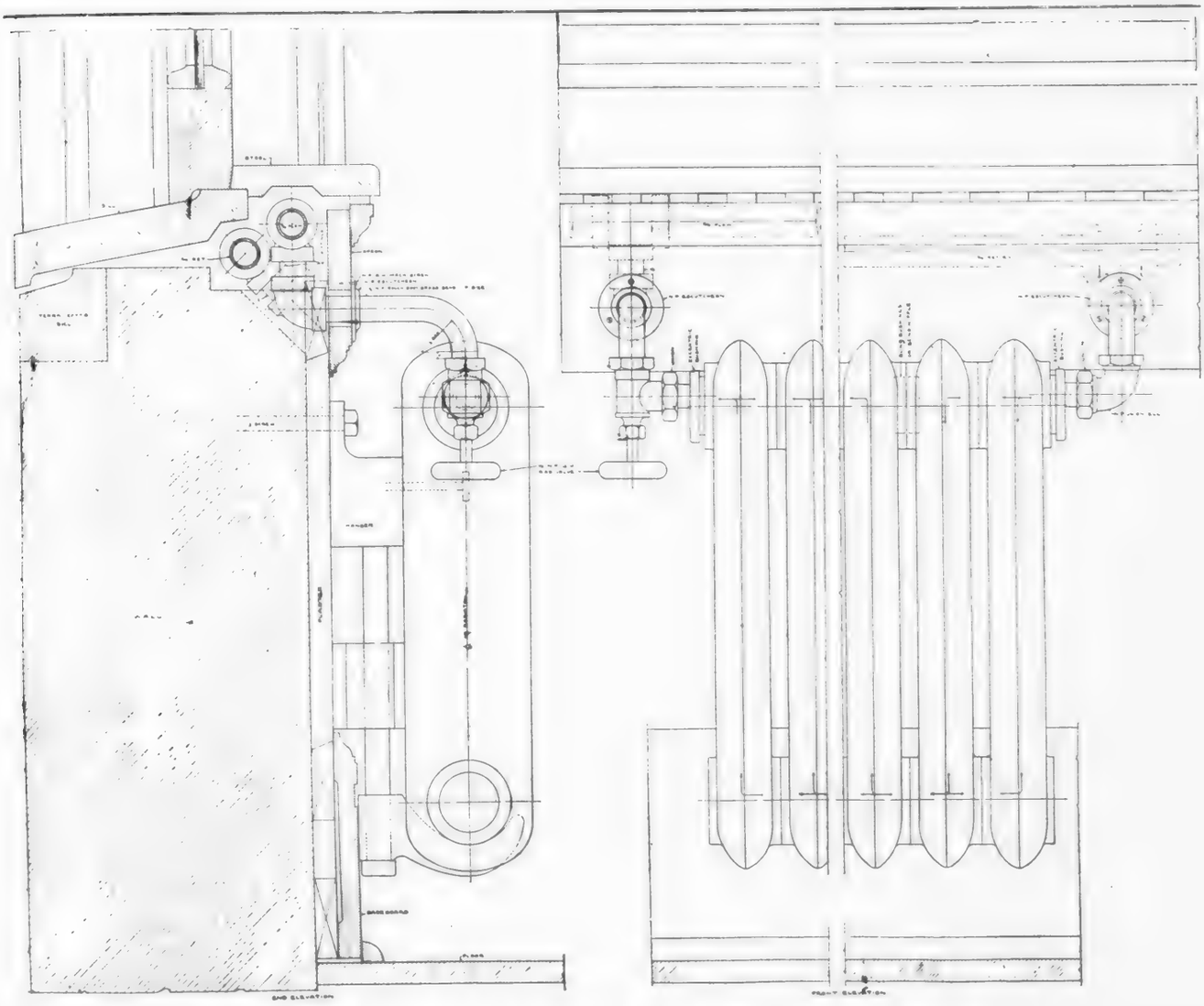
The condensation from the convertor and water heater passes through high-pressure traps to the condensation tank, which is similar to the one used for the theatre and preheats the domestic water. From there it passes through the meter to the sewer.

Two complete vacuum cleaner systems are installed, one for the office building and one for the theatre. A janitor's closet with slop sink and other accommodations is provided on each floor. The toilets have an independent exhaust system of ventilation.

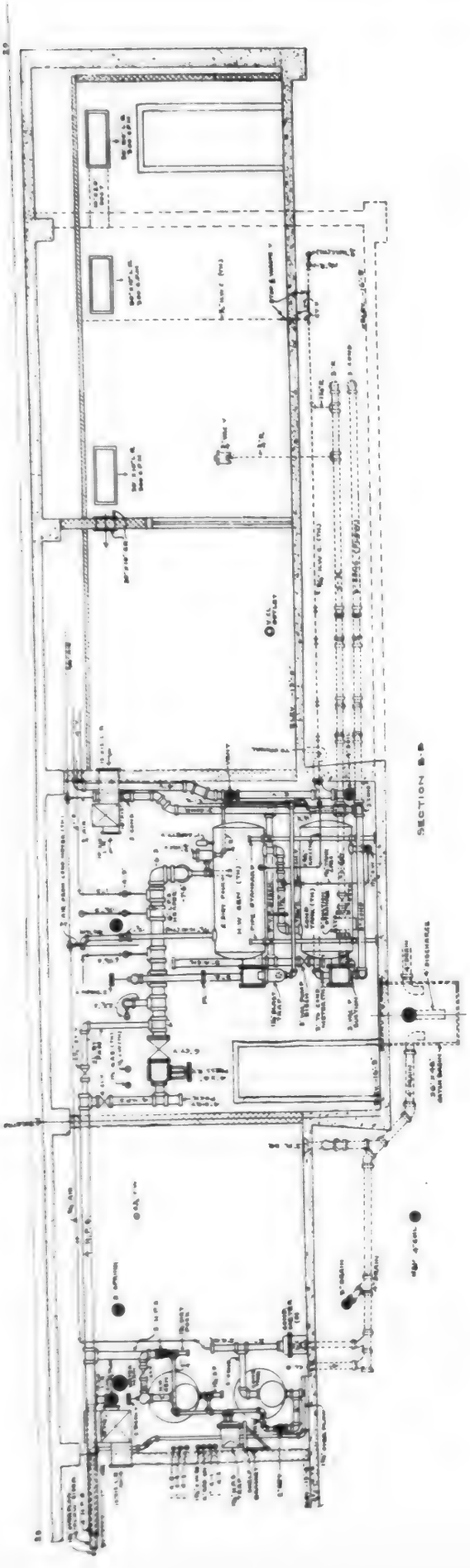
All plumbing fixtures are of solid porcelain with heavy nickel-plated brass fittings, and are all of the most sanitary design.

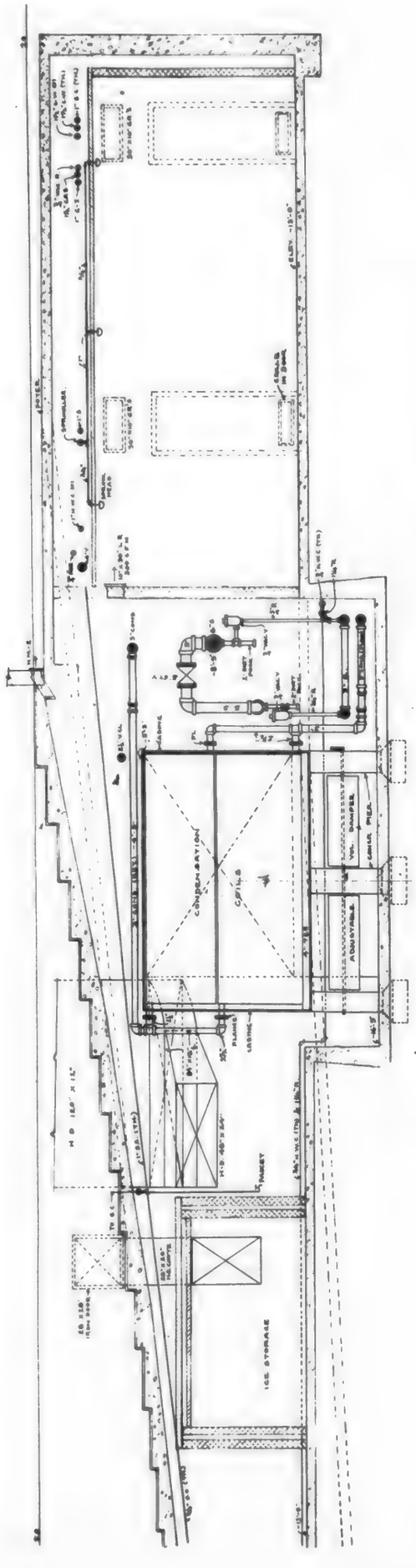
FIRE PROTECTION SYSTEM.

The fire protection system for the theatre consists of an automatic sprinkler system of the wet-pipe, alarm-valve type with automatic sprinkler heads located in the entire stage and



DETAILS OF EQUIPMENT IN MACHINERY ROOM, PANTAGES THEATRE BUILDING.





DETAILS OF EQUIPMENT IN MACHINERY ROOM PANTAGES THEATRE BUILDING.

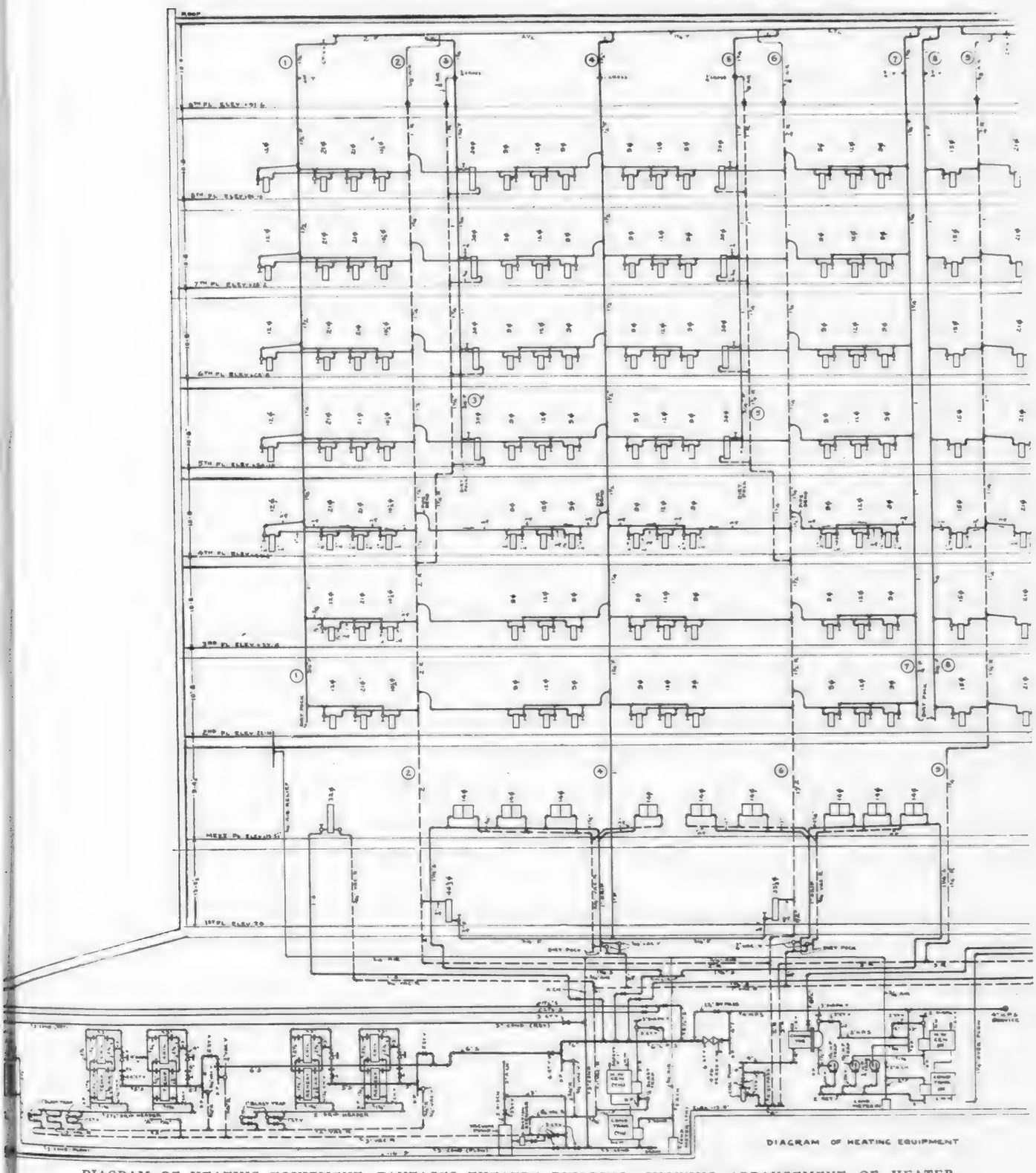
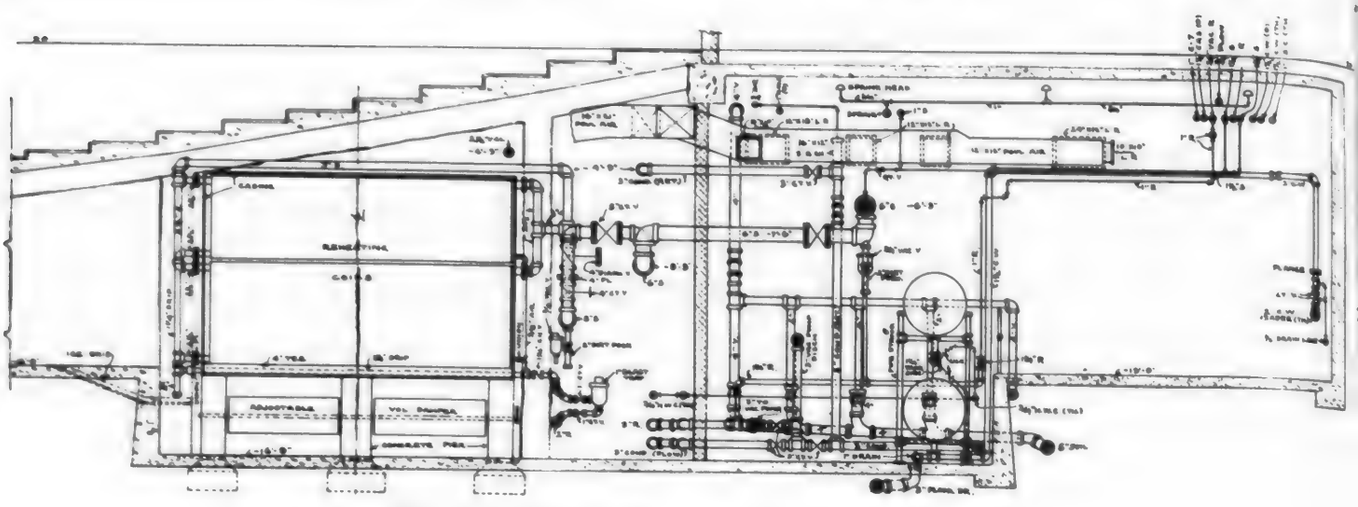


DIAGRAM OF HEATING EQUIPMENT, PANTAGES THEATRE BUILDING, SHOWING ARRANGEMENT OF HEATER COILS AND PORTION OF BUILDING ELEVATION.



SECTION D-D

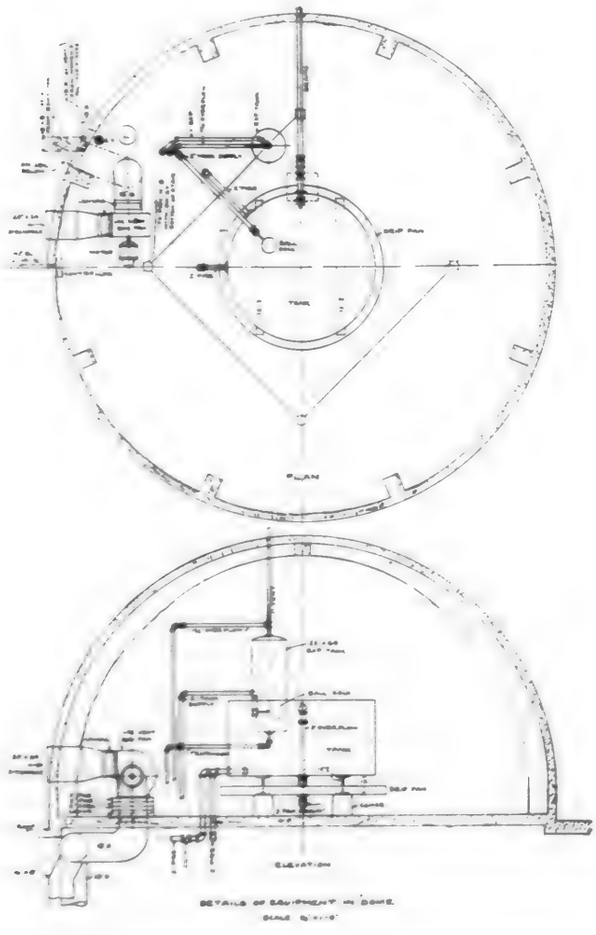
DETAILS OF MACHINERY ROOM, PANTAGES THEATRE BUILDING.

dressing room section and in the proscenium arch. A similar separate system is installed in the entire basement of the office building.

Wet standpipes are installed in the theatre with hose outlets in the auditorium and balcony and on the stage, in the dressing room section and on the fly galleries. The office building has two wet standpipes, each has hose outlets on each floor and in each store. A dry stand pipe with valved hose outlets at each floor and on the roof is affixed to each of the two fire escapes, for the use of the fire department. Fire alarms are located at each hose outlet and the automatic sprinkler systems are equipped with automatic alarms.

All pipe lines and apparatus in the mechanical and sanitary equipment are painted according to a color code.

B. Marcus Priteca, A. R. C. A., A. I. A., Seattle, was the architect for the building. The heating, ventilating and plumbing were installed by Arthur Hess and the electrical equipment was installed by the Golden States Electric Co. of Los Angeles. The entire electrical, mechanical and sanitary equipment was designed by Erwin L. Weber, E. E., M. E., Seattle.



DETAILS OF EQUIPMENT IN DOME.

Progress of Electric Heating.

Replying further to the inquiry published last month regarding large electrically-heated installations, it should be noted that although the most impressive feature of electrical heating is its high cost, this method has some important advantages, depending upon the specific application. Thus, large plants located near water falls, and where coal is expensive, sometimes make use of surplus power for heating, also the application of electricity in industrial work to heating of baking and drying ovens has come into general use, since for such purposes, as compared with gas, it is clean and does not vitiate the air. Products of combustion do not collect on the work, labor is reduced, and a better and more uniform product is obtained with the ease and safety of operation peculiar to electric power.

The *Electrical Record* for March, 1921, describes an installation of 2200 K. W. electric heaters in one of the new mills of the Canadian Cottons Co., the building in question being 184 ft. wide by 410 ft. long and two stories high. Heaters are concentrated into two centralized systems, one for each half of the building, and are placed in housings similar to those used with steam coils, air being drawn through the heaters by suction fan, and distributed through the building by means of vent pipes.

Electric contact-making thermostats are used for maintaining the temperature constant within narrow limits. These, in connection with magnetic contractors, hold the temperature constant, continually and entirely automatically at 65° F. throughout the entire 24 hours, irrespective of the outside temperature which may be as low as 20° F. below zero. The installation is thoroughly safeguarded, so that in the event of the power going off the motor driving the exhaust fans, the current is automatically cut off the heaters. It is further safeguarded to the extent that if the temperature within the housing goes beyond a predetermined limit, the heaters are automatically disconnected from the line. In the event that the temperature within the room, should go beyond a given point, due to the possible failure of the controlling thermostats, a separately-operated thermostat will cause the sounding of a loud gong, which will be sufficient to attract the attention of the watchman day or night.

THE IMPORTANCE OF PROPER CONDENSATION CONTROL

How This Factor Affects the Efficiency of a Steam Heating System and May Determine Its Ability To Compete with Warm Air

BY MALCOLM C. W. TOMLINSON.

IT is a very human characteristic to lose sight of the essential. Not only do our eyes deceive us but our minds find paths of least resistance by laying stress on the non-important. The heating contractor, the architect and, in many cases, the heating engineer try to solve their clients' troubles or problems by changes in piping, by rearranging radiation or by installing steam specialties. The results are, in many cases, of little value. In the meantime a factor, which should be perfectly apparent, may be the one that is keeping the expense of operation at an abnormal point. This factor is the heat in condensation.

Heating constitutes one of the largest costs in the running expense of most buildings, yet it is usually considered last. The heating contractor and the architect are seldom interested in what it costs to operate the system. Many layouts are made with the aid of data of doubtful authority. Rule-of-thumb methods for figuring radiation increase the unreliability of the "design." Even the cost of cheap insulation is scrutinized carefully with frequent decisions in favor of bare mains. It is, therefore, not surprising that the cost of heating in home, factory and business buildings is often way beyond that which is reasonable.

A correct understanding of condensation is of prime importance. It may be the medium used by air, scale or dirt in blocking the heating system. Its main requirement is that it be moved with sufficient rapidity to provide room for steam in radiators and heaters, but it is also a thief which will steal most of the heat from the steam with which it comes in contact and the only recourse is to control it carefully if operating expenses are to be kept down. This last point plays a large part in the efficiency of any heating system and it is the feature of condensation which this paper proposes to discuss.

HIGH TEMPERATURE OF RETURN MAINS THE SIGN BOARD.

If the management would know whether or not its heating system is economical in the use of steam it should go to the basement and feel the return piping through which all condensate must run. Where the temperatures are high it will be impossible to hold the hand on the pipe and this condition is the signboard which points to waste. A thermometer, whose bulb is held against this same pipe and protected from cooling air currents by a covering, is a better means of getting at the actual facts. If the system is uneconomical the temperature recorded on the return piping will be around or above 150° F. Many direct heating systems can be operated with condensate temperatures between 85° and 125° F. while in no case is it necessary for this temperature to be over 125° F.

Now for every degree Fahrenheit above the minimum requirement which is found in the condensate there is approximately 100 heat units lost per hour per pound of condensate. Furthermore, for the average heating system, the boiler operation is conducted around 50% for efficiency and the heat units transferred from the coal to the water will be approximately as follows per pound of coal burned:

Coal	*B. T. U. Transferred per Pound of Coal.*
Anthracite	8000
Bituminous	5800
Free-burning bituminous, with down-draft boilers	7200

It therefore follows that, for every hour of operation and for every pound of condensate, each degree difference between the condensate and the minimum possible temperature, in the Fahrenheit scale, represents a waste in the usage of steam and coal.

For an example, take a direct heating system for which the following data apply:

Coal	Bituminous (5800 B. T. U. delivered to water per pound of coal) 2000 lbs. per ton
Temperature of condensate	200° F.
Condensate temperature desired	100° F.
Operation	10 hours per day—225 days in heating season
Average condensate	2300 lbs. per hour.

The maximum possible wastage in coal would be as follows:

$$\frac{(200-100) \times 10 \times 225 \times 2300}{5800 \times 2000} = 44.6 \text{ tons}$$

If 9 lbs. of water were evaporated per pound of coal fired, the total coal requirement per season would be:

$$\frac{10 \times 225 \times 2300}{9 \times 2000} = 287.5 \text{ tons}$$

The saving in using the extra heat, represented by 100° F., would be:

$$\frac{100 \times 44.6}{287.5} = 15.5\%$$

It should be understood that the above method of figuring the actual savings is an approximation. This information is, however, valuable in that it shows the losses, roughly, that are usual in heating.

Where the supply exceeds the demand, there is little which can de done to eliminate waste unless more uses are found for the exhaust. Although this steam is a by-product every pound should be used, as such usage reduces the total cost of operating the power plant.

HOW TO REDUCE EXCESSIVE TEMPERATURE OF CONDENSATE.

Excessive temperatures of condensate can be brought down to normal by the use of thermostatic traps, thermostatic control or modulating valves. In the first case a volatile liquid in the trap expands to close the opening at a given temperature for which it is prepared by the manufacturer. These traps are installed on the return end of the radiator and must be cleaned once or twice a year. Thermostatic control consists of special radiator admission or return valves which are operated by diaphragms controlled from a thermostat located at a central point and set at will for some given temperature. Modulating valves are provided with ports of various sizes so that each position of the handle will admit a definite amount of steam. These valves would furnish a satisfactory control if those who turn the steam on or off were invariably careful to make proper adjustments of the handle.

Steam heat can only hope to compete with warm air where it can be proven definitely that the operating cost is very much lower and that the difference in first cost is, therefore, justified. In view of the competition which is ahead of every business the contractor who sells steam heating, the architect who wishes his client to install this form of heating and the heating engineer who has an earnest desire to give better service must all wake up to the realization of these facts and give the public the better service which can be secured from proper condensatoin control.

WHAT ABOUT OZONE?

Details of the Recently-Completed Chicago Tests to Determine the Status of Ozone for Ventilation

BY E. VERNON HILL AND JOHN J. AEBERLY, M.E.,
of the Chicago Department of Health.

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IN all twenty experiments were conducted, comprising *104* tests. Naturally many new problems developed during the work which made us anxious to definitely continue and expand the researches undertaken. The study of the action of ozone in oxidizing odorous substances should be made with the view of determining the amount of ozone required for different substances. The action of ozone as a bacteriacide on pathogenic bacteria should give interesting and valuable information. We have recently obtained a Sanborn metabolism apparatus for determining the amount of carbon dioxide given off by the human body. It is our intention to carry out some experimental work with a subject at rest, determining the amount of CO_2 exhaled in an atmosphere of ordinary air as compared with an atmosphere charged with ozone. These and the other experiments referred to will doubtless form the subject of a future paper.

We believe that the method developed for determining ozone concentrations is of practical value. The results obtained in the daily use of the apparatus are very satisfactory and consistent. We do not hesitate to urge that anyone making observations of the action of ozone use this method, as a definite knowledge of the concentrations will throw considerable light on the results obtained by its use. This is the only way to make observations of real value.

We made no tests as to the production of nitrogen compounds given off by the machine, as this work has just been completed by Jones and Yant, U. S. Bureau of Mines, and recently reported at the annual meeting of the American Society of Heating and Ventilating Engineers. The investigation of Jones and Yant was made with ozone apparatus of the glass dielectric type, spoken of by them as the tubular type, and with a machine using mica composition as a dielectric. This they mention as the square type. The highest ratio of oxide of nitrogen to ozone in the tubular type was 1 to 131 and in the square type 1 to 111. From our experiments it is evident that in occupied buildings the ozone concentration practically never exceeds 0.1 of one part per million. This would mean, according to the experiments of Jones and Yant, that the maximum concentration of oxide of nitrogen would not be 0.001 of a part per million, which is so low that it could not possibly have any effect, deleterious or otherwise. The conclusion from the report of Jones and Yant is as follows:

"At any rate, for the present the quantities of oxide of nitrogen produced by the machine generators tested are so small, 0.007 parts per million when the ozone concentration is one part per million, that the physiological effects from the oxide of nitrogen produced by these generators seems to be negligible."

Tabulation of Experiments Conducted.

Experiment No. 1—twelve tests:
To establish relative merits of CdI and KI methods of tests.

Experiment No. 2—ten tests:
To standardize the chemical method.

Experiment No. 3—three tests:
To familiarize ourselves with the operation of the complete equipment.

Experiment No. 4—four tests:
To further familiarize ourselves with the equipment.

Experiment No. 5—five tests:
To determine the relation of ozone production to power input.

Experiments Nos. 6 and 7—nine tests:
To determine the relation of ozone production to change in velocity of air through machine.

Experiments Nos. 8 and 9—five tests:
To determine dissipation of ozone in clean galvanized-iron ducts.

Experiment No. 10—seven tests:
To determine lowest concentration of ozone that could be detected.

Experiment No. 11—one test:
To determine oxidizing effect of ozone in clean galvanized-iron ducts.

Experiment No. 12—two tests:
To determine dissipation of ozone in dust laden galvanized-iron ducts.

Experiment No. 13—three tests:
To determine action of ozone on bacteria.

Experiment No. 14—six tests:
To throw light on the action of ozone as a deodorant.

Experiment No. 15—three tests:
To determine effect of ozone on molds.

Experiment No. 16—one test:
To determine effect of higher ozone concentration on bacteria.

Experiments Nos. 17 and 18—sixteen tests:
To determine ozone production under varying temperature and humidity.

Experiment No. 19—two tests:
To determine effect of high concentration of ozone on bacteria.

Experiment No. 20—sixteen tests:
To determine effect of light on ozone and gain a knowledge of the stability of ozone.

We wish to direct attention to experiments 11 and 12, which were conducted for the purpose of determining the dissipation of ozone in both clean and dust-laden galvanized-iron ducts. The drop in ozone concentration was very small in both experiments, much less than was anticipated. These experiments, together with experiment 20, indicates that ozone is a more stable substance than is generally supposed. It can be distributed through a duct system of considerable extent without material loss, assuming that there is no water present in the system in the form of a liquid.

In experiments 1 to 4 while testing our apparatus and method we found that in passing air containing ozone through a test tube containing water, or even through a wet test tube, a considerable portion of the ozone was absorbed. While as compared with other gases ozone has a low solubility, still, when we consider the extremely low concentrations of ozone in the air that we are dealing with, it is apparent that a very small amount of water in the liquid state will absorb the ozone. This opens up the question as to the location of the ozone apparatus in relation to air washers and some experimental work now going on indicates that a very satisfactory combination is an ozone machine and washer so located that the air is ozonized before entering the washer. After the water becomes saturated with ozone the excess passes

into the system. The water is sterilized by the action of the ozone and in some installations this is a very desirable condition.

In experiments 17 and 18 the fact is brought out clearly that ozone production decreases materially with an increase in the moisture content of the air. This is a fact of practical value and should be borne in mind by the manufacturers of equipment and provisions made for varying the capacity of the machine in accordance with weather conditions.

The effect of ozone on bacteria and molds was investigated. (See experiments 13, 15, 16 and 19). The reader should bear in mind that these experiments were carried out with a view of determining what concentration would *destroy* the organisms in a comparatively short period of time. It would be interesting to note what effect very low concentrations would have, not in destroying these organisms but in inhibiting their growth and development. The wide application of ozone in cold storage plants, particularly in rooms where sausages are aged, is due largely to the fact that it prevents the growth of mold. In these installations the concentrations range from 0.5 to possibly one part per million.

In several of the experiments conducted in the series under discussion the fact was brought out that molds would not develop even in low concentrations of ozone. In 27 plates exposed in the Resin' Orr School no molds developed, although the ozone in this building was barely to be detected in the class rooms. It is evident, therefore, that low concentrations will inhibit the growth of molds, and it is probable that they will also inhibit, to an extent, at least, the development of air bacteria. It should be noted in this connection that the ordinary air bacteria with which our experiments were conducted are highly resistent to most germicides, much more so than the pathogenic organism. A plate exposed in the open air in the bright sunlight will collect and from it we may incubate any number of air bacteria, while the same sunlight will destroy many of the pathogenic organisms in a short time. It is evident, therefore, that further experiments should be conducted to determine what concentrations of ozone are effective in destroying the common pathogenic organisms.

PHYSIOLOGICAL ACTION OF OZONE.

We have made no experiments directly to determine the physiological action of ozone. Its continuous use for one year in the Resin' Orr school without any visible or demonstrable ill effects on the pupils and with the continued favor of 95% of the teachers, argues in its favor. The more extensive experience with ozone in the St. Louis schools also is favorable.

Ozone has been in use in the London tubes for many years and the statement is made that the workmen employed therein have improved in health since the ozone equipment was installed and that they were remarkably free from influenza during the pandemic of 1918. There is a considerable amount of evidence of this kind, hearsay and more or less untrustworthy, to the effect that ozone in low concentrations exerts a favorable effect on persons subjected to it over extended periods of time. There is, however, so far as we know, no evidence of any kind to show that low concentrations of ozone are harmful.

It is true that some authorities after observing the strong oxidizing effects and irritating action of ozone in high concentrations have argued that low concentrations must be proportionately injurious. It should be pointed out that there is no logic whatever in this position. Many substances can be mentioned that are extremely toxic in large doses, strychnine, arsenic, mercury and many other drugs and chemicals that have distinct tonic, even curative effects when the dosage is small Some chemicals, for example, iodine and phosphorus, are absolutely essential in small doses for the maintenance of life, whereas large doses are extremely poisonous and may cause death.

Another point that should be investigated is the idiosyncracies of individuals to ozone. During our experiments Mr. Aeberly seemed to be much more susceptible than the other experimenters and the odor of ozone could be detected on the exposed skin surfaces several hours after he had left the cabinet and the place where ozone was generated. The odor was still present on his hands even after he had washed them with soap and water. This peculiar phenomena was not observed on any of the other persons subjected to the ozone.

EFFECT OF ODORS ON BREATHING.

Ozone is a valuable deodorent and it should be borne in mind that objectionable odors have a distinct physiological significance. Persons in an atmosphere containing objectionable odors do not breathe deeply and consequently do not aerate the lungs and blood as thoroughly as where the air is pleasant. Ozone probably has some favorable physiological action by reason of its deodorizing properties.

CONCLUSION.

The action of ozone must be considered as identical or at least very similar to the action of nascent oxygen. Comparing concentrations by volume of ozone with other commonly used gases, disinfectants or germicides, we find ozone much more active than any of them. Sulphur dioxide is ordinarily used in disinfecting rooms after contagious diseases and in the destruction of vermin, etc. It is produced by burning ordinary sulphur, the dioxide being formed by the combustion. Hiss states that a concentration of sulphur dioxide of 8% is necessary for proper disinfection in a period of twenty-four hours Formaldehyde, according to Brunn, should be used in concentrations of 25 grams per cubic meter, which is equivalent to 18,600 parts per million. In the holds of vessels and other places infected with rats and vermin hydrocyanic acid is frequently emoplyed in concentrations as high as 850 parts per million. In our experiments ozone in equivalent concentrations exerts a much stronger bacteriacidal effect than any of the germicides mentioned. Comparing ozone with sulphur dioxide we find that it requires 160 times the amount of this substance to obtain the same bacteriacidal effect that we get with ozone; 37 times the amount where formaldehyde is used and 1.7 times the amount where hydrocyanic acid is used.

The fact that ozone is a deodorent and a powerful germicide, and the further fact that it can be generated conveniently at a very low cost makes it a substance that should receive the careful consideration and study of the engineering profession in connection with ventilation and air conditioning work.

A method of application that gives more promise of excellent results is to install the equipment with sufficient capacity to build up comparatively high concentrations when the building is not occupied. In schools, for example, the ozone equipment should be operated at a capacity to give perhaps 0.01 part of ozone per million when the building is occupied, a sufficient quantity only to act as a deodorant and to slightly freshen the air. After the pupils have left the building the full capacity of the machine should be used, closing all openings, recirculating the entire amount of air and building up a sufficient concentration to exert the maximum deodorizing effect throughout the building, the duct work and the mechanical equipment. The surgeon would not think of using instruments that were not thoroughly sterilized. Possibly we will learn that frequent sterilizing of the ventilating equipment in a school building is the answer to the numerous complaints now received regarding its operation.

Another application that holds some promise is the use of ozone in connection with air washers. With the ozone equipment in front of the washer the water that is recirculated absorbs a certain amount of the gas which acts to sterilize the water and eventually the air passing through it. To what extent this can be accomplished from a practical standpoint remains to be seen.

The continued use of ozone in connection with mechanical ventilating equipments depends largely upon the adoption of scientific methods of manufacture, installation and operation and upon the continued observations regarding its physiological effects.

The End.

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DURING this and the ensuing two months the Research Laboratory of the American Society of Heating and Ventilating Engineers will be the object of a drive for funds to carry on its work. There are convincing reasons why this effort should enlist the support of the entire heating and ventilating industry, to say nothing of those industries in related fields. It is necessary to emphasize this point because there is a distinct feeling in some quarters that the laboratory is not fulfilling the hopes and aspirations of its supporters. One hears the question asked, what has the Research Laboratory actually done to benefit me in my work? Reference to one of the laboratory's most tangible achievements in the compilation of data sheets on direct radiation are met by the rejoinder that they represent tests made elsewhere and not under the direction of the laboratory.

The fact is that due to the character of the Research Laboratory and the state of the art when the laboratory was established, in 1919, there was some vitally necessary preliminary work to be done in arranging the program to be taken up and the apparatus and methods to be used. No one who has not been engaged in this kind of work can begin to appreciate the care required to obviate criticisms from one angle or another of the results obtained. How often, for instance, is the remark heard that a given test appears to have taken no note of this or that factor which might easily change the results.

It is not exaggerating the situation to state that the laboratory is almost at the point where it can begin to give out authoritative data of its own. Once that flow begins it may be expected to continue. This will give the work a practical value for those who are giving up their good money towards its support. But beyond this there is a vision which is being opened by the Research Laboratory of the future of the heating and ventilating industry which is nothing short of inspiring. Already the laboratory is recognized as the most progressive move ever undertaken by any engineering body in the world. Due to this fact alone it has already raised the heating and ventilating profession to a higher plane. There is every reason to believe that as time goes on the laboratory will be recognized as the supreme court in this field of engineering whose dictums will be accepted not only by the engineering public but also by the general public. That, it seems to us, is the appeal in the establishment and carrying on of the laboratory. It is going to put the art on such a sound basis that its mysteries will no longer be hidden from the general public but will be known to all and will make the general use of approved methods as natural as they now are to the comparatively few.

PROGRESS in mechanical design through the pooling of patent rights is an alluring subject. It was recently stated in these columns, in connection with an article on fan design, that perhaps the future will see developed a method for combining patent rights without "restraint of trade" but rather with the resulting production and sale of even better and more fans than at present are produced and sold. One correspondent, in taking the negative side of the question, makes the point that far greater progress has been made in the art of fan design and development of high-efficiency fans through the competitive efforts of the individual companies than would ever have been secured through the combined efforts of the fan designers. Under the present competitive arrangement, runs his argument, when one manufacturer produces a fan superior to those on the market, the other companies find it necessary to develop a fan which will surpass the performance of the other competitor's latest development. This, it is pointed out, has led to remarkable advances in fan designing in the last fifteen years. Whereas a fan with a static efficiency of 40% was all that could be secured from fans twenty years ago, fans are now obtainable with a static efficiency of more than 70%, and with a total efficiency of 81%. This efficiency does not credit the fan with any of the intake losses, as the efficiency is based only on the work developed on the outlet of the fan. In centrifugal pump practice the suction head is taken into account, as well as the discharge head. This, of course, is proper where the water is lifted several feet into the pump suction, but in crediting the pump with the suction lift, the pump is credited with any entry head losses, which entry losses are not credited to a fan in determining its efficiency.

Of course it might be said in reply that there is another side to the question, as superior design is only one factor. Superior design and low cost, however, are big factors to the purchaser and the public. The struggle for advantage, outside of the design, no doubt adds to the cost of the apparatus and the question is whether this same addition applied to design improvement would produce more for the purchaser and the public, because in the long run the advantage lies in better service to both of these classes.

SERVICE DEPARTMENT

Quick Methods of Sizing Pipes For Forced Hot Water Work.

QUESTION: Replying to the invitation in your magazine, I should like to have you publish an article on quick methods of determining proper and economical piping sizes for forced water heating systems.

ANSWER: Allen and Walker in "Heating and Ventilation," tell how to size pipes economically in forced water heating systems, and the following is taken therefrom:

"The quantity of heat delivered per hour may be expressed by the equation $H = Q\ (t_1 - t_2)$ in which H = quantity of heat delivered per hour, Q = weight of water pumped per hour. $t_1 - t_2$ = drop in temperature of water.

"It is evident that the quantity of water and the temperature drop may vary, the requirement being that their product remain constant. As the temperature drop is increased, however, the average temperature of the radiators is lowered and somewhat more surface must be installed. It is common practice to allow a temperature drop under maximum conditions of about 20° F."

"Before a circulating pump can be intelligently selected, it is necessary to choose the differential pressure at which the system is to be operated. If a large pressure drop is allowed, the pipes can be made relatively small, but the power required for pumping the water will be greater. Although it is true that the energy used up in friction is converted into heat and is therefore utilized, the energy thus recovered is only a portion of the energy input to the pumping unit. The cost of the power must therefore be taken into consideration. If the pump is steam-driven and the exhaust used for heating the water, the cost of power will be lower than if current is purchased for a motor-driven pump. In each case a study should be made, balancing the annual investment charges of the piping system against the cost of power to determine the most economical combination. The pressure drop usually allowed is from 10 to 30 lbs. The velocity of flow in the pipes is limited to about 40 in. per second in buildings where the noise produced by a higher velocity would be objectionable. In industrial buildings, no such limit is imposed.

"The calculation of the pipe sizes in a forced circulation system is much more important than in a gravity system, because the former does not possess the 'self-regulating' property of the gravity system. If any one circuit is unfavorably designed, there will be a tendency for it to be short-circuited. Furthermore, the resistance of the entire system must be made approximately equal to the rated head of the pump. The precedure in designing a forced circulation system is as follows: The heat loss from the building having been computed, the temperature drop in the radiators is chosen and the amount of water to be supplied per hour is computed from the formula previously given. From a consideration of various factors, the differential head is chosen and a pump is selected which will operate most efficiently under the given conditions. The piping must then be designed so that this differential pressure is used up in friction."

The general scheme followed in choosing the pipe sizes is similar to that used for a gravity system, the available circulating head, which in this case is produced by the pump, being balanced by the pipe friction." However, to cover this subject at greater length would not be advisable, since all necessary data may be readily obtained by reference to such books as "Heating and Ventilation," Vol. I, by Harding and Willard, "Central Station Heating," by Gifford, and "Power, Heating and Ventilation" by Hubbard. Meier's "Mechanics of Heating and Ventilating" takes up the question of pipe sizes very thoroughly, taking into account all variables affecting the problem, and while the method given is complex and not readily acquired, once it is mastered, the use of the charts as given therein will be found to take but very little time, with the further advantage that the results will be the most accurate obtainable.

How and Where to Use Automatic Air Traps

QUESTION: I should like information regarding makes of small automatic air traps suitable for heating coils in forced water heating systems.

ANSWER: Small automatic air valves are designed and intended for use with steam heating only, and are not sold by the manufacturers for either forced or gravity hot water circulation. Instead, compression or positive type air valves are used at radiators in hot water work, since all that is usually required is to free the system of air when * first filling, and this is accomplished by means of the open expansion tank. In steam systems, however, a certain amount of air is released from the water in the boiler upon heating, also whenever steam is turned off. The vacuum resulting from the remaining steam when condensed in pipes draws in air at the air valves, bonnets of radiator valves, or other points, and this air must be driven out of the system when pressure is raised again.

Large automatic air valves which quickly relieve considerable quantities of air are another matter, and these are used for certain conditions in forced hot water circulation systems when the installation is of fair size. Such valves are installed at the high points of the system. Some of the large heating contractors, who do work of this nature, have used steam traps of the smaller size turned upside down, and for that matter, there seems to be no reason why some of the large float-vent traps used on return lines of vapor heating systems could not be applied with equal success. None of these valves is necessary, however, if there is an expansion tank to which small air lines can be run from the top of the risers, though conditions might arise in a group of buildings comprising one large water heating system where their use would be required.

* Tops of radiators connected to drop risers must also be vented through compression air valves when risers are refilled after draining.

Prevention of Condensation on Glass of Saw-Tooth Weave Sheds.

QUESTION: What is the best location of radiating surfaces for saw-tooth weave sheds, with the idea of getting the best distribution of heat to prevent condensation collecting and dripping from the roof and glass, and to overcome dry rot in roof plank as far as possible?

ANSWER: Condensation on glass of saw-tooth weave sheds may be prevented by locating the greater part of the radiating surface directly beneath the glass, and in addition as is sometimes done, using double sash in the skylights with a line of pipe between them. This not only places the coils well out of the way, but also locates them where the greatest heat losses take place, due to extreme exposure to winds and large area of glass and roof surfaces, which are much greater with saw tooth construction than with a flat roof. Coils should be placed so as to avoid shutting off light, and some of the radiating surface should be extended along the side walls below the windows.

Humidity in textile mills should be controlled to a very close

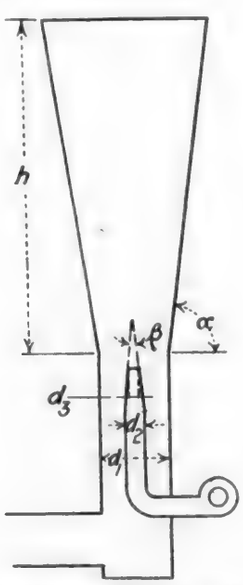
degree, since the presence of frictional electricity, generated by the motion of belts, pulleys, running stocks and machinery, is a source not only of annoyance but of positive loss to mill owners. In carding and spinning particularly, electricity has the effect of causing a change of several numbers in the yarn, and as much as 3% in the weight, weakening the yarn and causing it to snap and break, while the quality and width of woven goods is noticeably affected.

Because of this high degree of humidity which it is necessary to maintain, excessive condensation on glass surfaces is the more difficult to avoid unless ventilation is provided as well as heating. Also, windows generally are closed, and the heat from the large number of operatives and moving machinery is considerable, so that ventilation becomes all the more desirable. If an air washer is provided, close regulation of the humidity may be obtained and the cost of ventilation considerably reduced by recirculation, particularly in the colder weather. Also with considerable belting and shafting and a low roof, the standpipe method of duct distribution may be used and roof ventilators provided to allow vitiated air to escape.

Induced Air Flow by Injected Blasts

QUESTION: I should like to have you publish an article on the exact proportions to give an injector for induced draft.

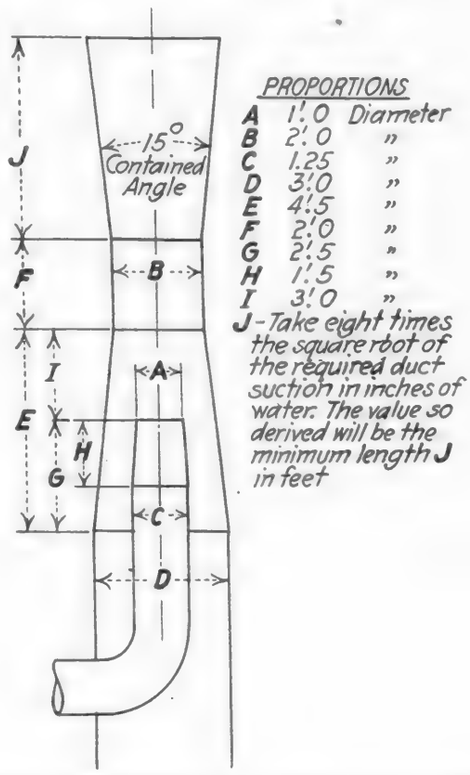
ANSWER: It is sometimes necessary to use the ejector principle for producing flow of air or gases. This results in considerably lower efficiency than would be attained by using a suction fan. An ordinary exhauster, or an induced draft fan is capable of an efficiency between 60% and 70%. A fan used as a blower for injecting a blast of air to produce suction will be about the same in this respect.



DESIGN OF INJECTOR FOR INDUCED DRAFT SUBMITTED BY CORRESPONDENT.

The efficiency of a Venturi orifice or mixing chamber is not a definitely determined quantity as very little research work has been done along this line. Even with an efficiency of 50%, which would be somewhat high even for a well-designed mixing device, the overall efficiency would therefore be 0.7 multiplied by 0.5, or 35%, so it would be much better to create draft by the direct application of an exhaust fan where this is possible. In some instances there are other considerations which outweigh the loss of power, such as the necessity of handling corrosive fumes, or flue gases at temperatures too high to permit of passing them through an induced draft fan.

About the first application of the ejector principle for producing ventilation on a large scale was at the Praccia Tunnel, between France and Italy, through the Alps. It was known as the "Saccardo" system, this being the name of the Italian engineer who developed it. High-velocity air jets were arranged around the portal of the tunnel so as to produce horizontal blasts parallel to the tunnel axis, spaced on close centers in the same vertical plane around the sides and curved upper surface. This scheme has been superseded by a later development whereby all the air passed through the tunnel is handled by the fans whereas with the Saccardo system, only a small proportion



PROPER PROPORTIONS OF INDUCED AIR OUTFIT.

went through the fans and nozzles, the remainder being induced flow. The use of the improved scheme resulted in considerable reduction in the expenditure of power.

It should be understood that a device of this kind operates because of the impact of the high-velocity jet from the nozzle upon the air or gas within the Venturi chamber or throat. The air within the throat is propelled into the évasé stack. This produces a partial pressure rarefaction in the Venturi chamber below the nozzle outlet. The atmospheric pressure causes air to be forced through the collecting hoods and ducts comprising the exhaust system. In this way the fumes to be taken away are drawn into the intake hoods, through the ducts to the Venturi chamber and are thence expelled to the outside atmosphere via the évasé outlet stack.

The attached sketch gives proportions of an outfit of this type which will render it an easy matter to design apparatus for any required conditions. The unit dimension is the diameter of the nozzle outlet.

To determine the area in square feet of the nozzle outlet proceed as follows:

$$\text{Area of nozzle in square feet} = \frac{\text{Volume in cu. ft. per minute}}{5{,}000\ \sqrt{\text{W. G. in inches.}}}$$

From this the area of the nozzle in square inches can readily be calculated and also the diameter of the nozzle in inches.

Example: Required the size of nozzle for a system to pass

3,000 c. f. m. with a calculated resistance of 1 in. water gauge. The resistance is, of course, the static pressure of the duct system figured in the regular way.

The area in square feet =

$$\frac{3{,}000}{5{,}000\sqrt{1\text{ in.}}} = 0.6 \text{ sq. ft.} = 10\tfrac{1}{2} \text{ in. diameter}$$

The fan which provides the nozzle with blast should be selected on the basis of handling 40% more air than is to be drawn through the ducts. In the case under consideration the volume to be handled by the fan will be 1.4 × 3,000 or 4,200 cu. ft. per minute. The static pressure against which the fan should be selected to deliver the required volume is three times the resistance of the duct system.

In the case under notice, therefore, the fan will have to be selected to be capable of handling 4,200 c. f. m. against 3 in. water gauge.—THOMAS CHESTER, formerly Chief Engineer, American Blower Company.

Heating and Ventilating Cost Data.

QUESTION: I should like to have you publish an article on estimating, giving methods and other data.

ANSWER: Gillette and Dana, in their handbook "Mechanical and Electrical Cost Data" define the general economic principles of engineering in a very complete and concise manner, the following being taken as an extract therefrom.

"Engineering is the systematic application of science to problems of economic production. The engineer's ultimate aim, therefore, is to effect a desired result at a minimum cost and a maximum profit. To this end, where it is feasible, the engineer should formulate a unit cost equation in which all the dependent variables and constants are included, and he should then solve for a minimum unit cost. But whether he is able to employ this ideal method or must use cruder methods, he must eventually express all the items in terms of money or its equivalent.

"Put differently, every problem resolves itself into the determination of quantities to which unit costs are applied. No economic problem can be solved merely by the use of qualitative terms; yet many a poor reasoner attempts to solve the most complex of economic problems without the use of a single item to which a definite cost is assignable. Volubility is vainly made to serve instead of valuation.

"If a unit cost has been so analyzed as to show the quantities of each kind of labor and of each kind of material involved in the production of the given unit, such a unit cost may be quite as serviceable a generation or more after its publication as it was when first published."

The above remarks are continued as a discussion by the authors throughout the introductory chapter; and the reader should find much of interest in "Mechanical and Electrical Cost Data." Certainly, estimating data, scattered about or poorly arranged is a liability instead of an asset. To have real value all items and quantities should be systematically listed so as to be clearly interpreted long after the record has been made. When this is done, occasional study of the data as itemized will readily show the amount of unproductive labor and just where costs may be reduced and profits increased, not only for future work, but in time for application to the work in hand.

With a fair degree of accuracy, such records show the proper time required to do the work and the length of time actually taken, the difference between the two being the measure of efficiency. Also, previous time studies of past work if carefully recorded will show how much saving may be made at any point and if sufficient to warrant any change in the method of handling the present work. Inefficient labor, errors of design or plan of construction, may also be discovered and corrected long before the loss becomes of any moment. This is particularly true if progress of the work is occasionally checked with the records and is much more satisfactory than belated realization that labor costs ran higher than the estimate, and for reasons but dimly recognized.

Reliable cost data make accurate estimates possible, so that the latter may often be used for material orders without further clerical work, and in this way they prevent shortage of materials in the order, with consequent delay, any error being promptly remedied

Forms for records may be arranged in any number of practical and satisfactory ways, but they should in all cases be comprehensive, the form used being secondary to the method of tabulating quantities.

There are also various elements that should be thoroughly understood in estimating, modifications after the contract is signed, designed to benefit the contractor and yet please the owner, the accomplishment of the work in the allotted time as figured in the estimate, the likelihood of delays due to unforeseen conditions, and the state of the market at the time the contract is taken and at the time the work is done. These are some of the main considerations and the allowances made will determine whether or not there is to be a profit on the job.

Other conditions that will effect the amount of profit are such items as the proper supervision of materials and the dispatch in providing them to avoid delay, both in the execution of the contract itself and in the occupation of each workman on the job.

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stituting Parts 3 and 4 of the Business Efficiency Course conducted by the National Trade Extension Bureau, Evansville, Ind. Parts 1 and 2 of this course deal with "Fixed charges" and "Estimating."

A Problem in Unequal Expansion of Pipe Lines.

Some valuable points on the best method of installing and operating a large steam pipe line to insure the line against breakage at the joints from unequal expansion of the top and bottom of the pipe were brought out in connection with some serious trouble arising from that cause in a recent installation. An 18-in. low-pressure steam line was installed as per the accompanying sketch. Steam was turned in the line slowly and no less than twelve flanges broke at the bottom due to unequal expansion.

The pipe is standard weight steel pipe with cast-iron screw flange joints designed for 125 lbs. working pressure. Pressure to be carried on the line, about 5 lbs. Pipe is anchored to concrete piers at points indicated and supported with rollers in chairs resting on concrete piers between points of anchorage. The 1-in. drips and discharge from vents are open to atmosphere.

In investigating the accident, the question arose as to whether it could have been avoided by turning steam into the line quickly. The question was also raised as to whether, if connections had been made and a steam jet injector installed so that a vacuum could have been obtained in the line before the steam was turned on, the pipe would have heated up evenly at top and bottom.

The installation of eight flexible joints, as shown in Fig. 2, were suggested as a remedy. Another suggestion was that an auxiliary warming steam line with 1-in. connections be attached to the bottom of the large pipe at frequent intervals.

In commenting upon pipe expansion problems in general and this problem in particular, William H. Driscoll, chief engineer for the Thompson-Starrett Co., New York, states that it is extremely difficult to design a line of steam piping of the size and length of the one in question in such a way as absolutely to avoid trouble in turning on steam.

"I had a similar experience about twenty years ago," continued Mr. Driscoll, "in connection with the water heating mains at the Breakers, the Vanderbilt residence in Newport, R. I. The mains were 16 in. in diameter and about 400 ft. in length, as I recall, and we had a great deal of difficulty in keeping the joints tight due to the unequal expansion. It was rather a startling experience for me and warned me to be more cautious in the installation of similar lines. I have since installed a number of jobs of a similar nature in tunnels over 700 ft. long, but have not yet learned how to install one of these lines without trouble.

"The first precaution we take is to make the flanges of steel and weld them to the pipe. The second is to make the line as

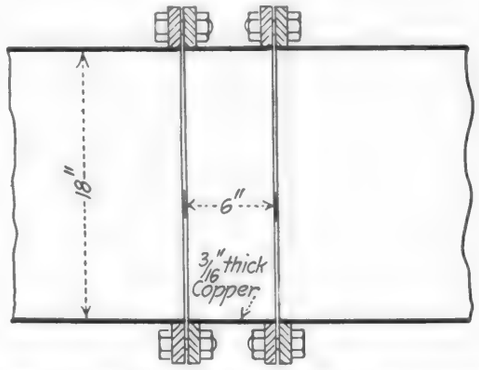


FIG 2. TYPE OF FLEXIBLE JOINT SUGGESTED AS A REMEDY.

flexible as possible by taking expansion up at intervals of 200 ft. with anchors midway of the expansion joints. The final precaution we take is to turn on the steam very slowly and nurse the job along until the piping is thoroughly warmed, regardless of the length of time it takes. I certainly would not think of turning on the steam quickly.

"As regards the question of creating a vacuum in the lines and then turning on the steam, I do not think this would be

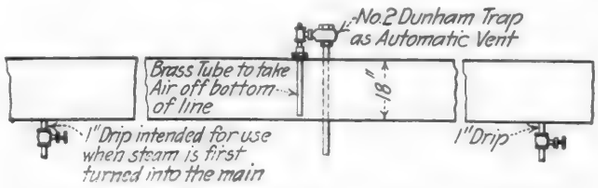

No.2 Dunham Trap as Automatic Vent
Brass Tube to take Air off bottom of line
18"
1" Drip intended for use when steam is first turned into the main
1" Drip

FIG. 3. AUXILIARY WARMING STEAM LINE SUGGESTED, WITH 1 IN. CONNECTIONS.

advisable as the expansion would be more rapid and I think that the effect of sudden expansion would be almost as bad as that of uneven expansion. I have never tried the scheme, however, and can only give my opinion of it. I do recall one instance in my experience in which compressed air was admitted into the lines to about 6 lbs. pressure before the steam was admitted. As the steam pressure rose the air was allowed to escape at the far end. The steam was thus held back at the will of the operator, permitting the pipe to warm more slowly and safely.

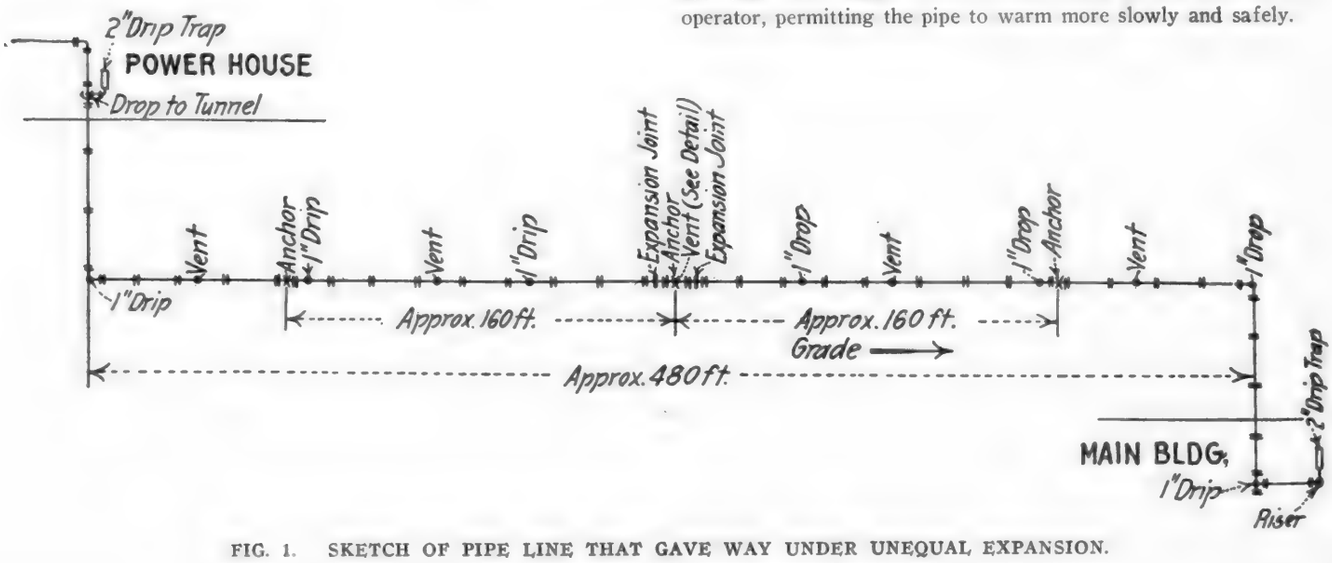


FIG. 1. SKETCH OF PIPE LINE THAT GAVE WAY UNDER UNEQUAL EXPANSION.

"I think that the suggestion as to the use of copper expansion joints offers the only genuine and practical solution of the problem. I am not quite sure that there is enough flexibility in the joint shown in the sketch (Fig. 2), although I am inclined to believe that it would be all right. If two of these joints were inserted in the line in addition to the slip joints already installed, it would provide the solution. Of course, such copper expansion joints would have to be placed at the proper intervals.

"I am inclined to think that in this particular case the breakage of the flange, while primarily due to the uneven expansion, was directly due to the fact that the curvature of the pipe caused the expansion joint to bind in its sleeve, thus preventing the free movement of the pipe."

CORRESPONDENCE

What Is the Matter with Hot Water?

EDITOR, HEATING AND VENTILATING MAGAZINE:

I have read with interest the article in THE HEATING AND VENTILATING MAGAZINE for November by F. Broadhurst Craig of England entitled "What is the matter with Hot Water." I agree that there is nothing whatever the matter with hot water and I believe that for the ordinary residence there is no superior method of heating.

I do, however, take mild exception to the writer's intimation that we on this side have not fully grasped the advantages of water heating and that "the application of hot water as a heating medium does not seem to be fully understood." I venture the statement that nowhere in the world will be found more carefully designed hot water systems or a better understanding of this marvelously adaptable method of heating, than in the United States.

Mr. Craig goes on to say that his conclusion as to our lack of understanding is based on such statements as "It is evident that the mains must be equivalent to the combined valve areas" and "it is difficult to give any tabulated data on this point." Both these quotations are evidently taken from my article "Advanced Ideas Applied in Design of a Gravity Water Heating System" in THE HEATING AND VENTILATING MAGAZINE, August, 1921, and perhaps therefore I can be pardoned for referring to them.

If it is not proper to make the maximum area of the mains equivalent to the combined valve areas of the radiating units, I would welcome a description of a more practical basis for determining these main areas. I have designed hundreds of systems on this basis and if their efficiency can be improved by any other method of design, I would very much like to know about it. I am speaking of course, of gravity systems and not necessarily of forced circulation systems.

The only reason which Mr. Craig gives for taking exception to this practice is that in what I assume to be an "overhead" system where one drop riser feeds a chain of radiators "three or four 1-in. radiator valves may be served by a single branch main of 1-in. diameter." I wonder if Mr. Craig ever installed three radiators in such a manner. If he has, I venture to say he made a serious mistake (unless the radiators were very small, say less than 20 sq. ft. each).

If radiators from 50 to 70 sq. ft. or even 80 sq. ft. each were installed in this manner and 1-in. tappings would be ample for radiators of these sizes on a two-pipe basement main system in a three or four-story building—the upper radiator would be very hot and the lower radiator very cold, relatively. The heat emission from each radiator would have to be figured on a different temperature range (between the water temperature and the air temperature) and the whole matter would be complicated from an estimating standpoint.

Much more uniform results would be obtained, if, in this case, the area of the drop risers throughout its length was equivalent to the combined area of three 1-in. valves and that is the practice which should be followed.

This, of course, means that the maximum main area (or in this case, the drop riser area) should be equal to the combined valve areas. I believe, in this case as in the two-pipe system that the practice suggested should be followed and that it is the proper method to follow. This being the case Mr. Craig's point would not seem to be well taken.

Some years ago there were installed in this section—and possibly in others—hot water systems using a one-pipe basement main. The supply branches were taken off the top of the main and the return branches off the side or bottom of the same main. These would circulate fairly well but are subject to the same criticism as I have made on Mr. Craig's 1-in. drop riser, namely, a progressive cooling of the water in the main and, therefore, in the radiators. Each successive radiator (from the boiler) was cooler than its predecessor. Under certain conditions the circulation in these systems is sluggish. So far as I know this practice has been discontinued.

In regard to the other criticism, namely, "it is difficult to give any definite tabulated data on this point," it is obvious that if one is not familiar with the text from which these words are quoted, it is impossible to intelligently discuss it.

The question of definite and accurate conclusions in connection with the design of water and steam heating systems is a very interesting one and I hope to have something to say along this line at a future time.

WILLIAM F. DEVENDORF.

Rochester, N. Y.

The Heat Reflecting Properties of Colors.

Items of interest to the heating and ventilating engineer sometimes come from unsuspected places, and thus we find worthy comments on the heat reflecting properties of colors in a paper by Henry A. Gardner, presented at Philadelphia before the Pennsylvania State Association of Master Painters and Decorators.

In considering the effect of the different types of rays of which light is composed, it was found that the clarific or heat-producing rays are conducted by painted or finished objects in widely varying degree, and this fact should be studied by the contracting painter who is called upon to paint the enormous areas presented by metal oil tanks, since such tanks may contain light distillates, which, upon becoming warm, produce highly expansible vapors. With black or dark-colored paints rapid absorption of heat takes places and considerable losses by evaporation are apt to occur, and white or light-colored paint should therefore be used for the finishing coats on oil storage tanks. Paints presenting a high gloss are, moreover, less absorptive of thermal rays than those presenting a matte surface.

The author's experiments were made on a series of small cylindrical metal tanks containing a standard amount of benzine and painted on their exterior surfaces in various colors. Through the pressure opening in the tops, accurate thermometers were inserted, and the tanks individually placed in a cabinet containing an open front where they were subjected to the rays of a powerful arc light for fifteen minutes. The rise in temperature of the benzine is shown in the following table.

RISE IN TEMPERATURE OF BENZINE CONTAINED IN SMALL TANKS PAINTED IN VARIOUS COLORS (GLOSS FINISH), WHEN SUBJECTED TO RAYS OF CARBON ARC FOR PERIOD OF FIFTEEN MINUTES.

Color.	Rise in Degrees Fahrenheit
Tin Plate	19.8
Aluminum Paint	20.5
White Paint	22.5
Light Cream Paint	23.0
Light Pink Paint	23.7
Light Blue Paint	24.3
Light Gray Paint	26.3
Light Green Paint	26.6
Red Iron Oxide Paint	29.7
Dark Prussian Blue Paint	36.7
Dark Chrome Green Paint	39.9
Black Paint	54.0

Although plain tin, on account of its smooth bright surface, gave the best results, it does not constitute a practical finish, as iron coated with tin corrodes on exposure unless protected with paint. Aluminum paint gave very good results, but it is not nearly as serviceable as a lead and zinc linseed oil paint.

Since, in the author's experiments, white paints faintly tinted gave substantially the same heat-reflecting properties as white paints, the former should be given the preference, as they are more restful to the eye and more durable on long-time exposure. The same consideration should be observed in the painting of gas-holders.

LEGAL DECISIONS

Breach of Contract for Heating Building by Openings in Walls Communicating with Adjoining Building.

The federal Circuit Court of Appeals, Fifth Circuit, holds, Farmers' Life Ins. Co. v. Foster Building & Realty Co., 272 Fed., 864, that the owner of an office building, who had a contract for the heating of the building, the contract expressly requiring heat to be furnished for a theatre therein at times when it was not necessary for the office part of the building, breached his contract by permitting openings to be cut in a wall to allow heat to pass to an adjoining building at the time heat was required for the theatre, thus increasing the load on the heating plant. The breach was one for which the furnisher of the heat could be adequately compensated by damages for the additional load on his heating plant; therefore cancellation of the contract was not authorized thereby. The owner, however, could not sue for specific performance of the heating contract until he compensated the other party to the contract for past damages and restored the building to its original condition.

Recovery on Quantum Meruit for Installing Heating and Plumbing.

Action was brought in the Michigan courts for work done and materials furnished in installing heating and plumbing in the defendant's building. There was a written contract for most of the work and a verbal one for extras. The plaintiffs claimed they were prevented by the defendant from completing the job, and in the circuit court they obtained a judgment for the agreed price for the work, less what the jury found it would cost the defendant to complete the job in accordance with the contract. The defendant appealed, claiming that he was justified in ordering the plaintiffs to quit, and that some of their work did not comply with the contract and had to be replaced, and it had cost him more than the contract price to finish the job.

The Michigan Supreme Court holds, Ginsberg v. Myers, 183 N. W., 749, that the defendant having made use of some of the work done by the plaintiffs, this gave the plaintiffs a right to recover upon a *quantum meruit*.

The work was not apportionable under the contract, and the award of damages under the form of action brought was held properly limitedly to a sum not exceeding the contract price, including the extras, less the cost of completing the work in accordance with the contract, and less any damages and added expense occasioned the defendant.

The defendant was not bound to accept the work if it was not performed in accordance with the contract, but in making use of some of the work done by the plaintiffs he was held to have accepted all, subject, however, to the right to be heard in relation to the value thereof in the action brought by the plaintiff.

The defendant complained of the trial court's instruction to the jury that the case was susceptible of a decision in exact figures and was not susceptible of a compromise verdict, that the jury must find one way or the other regarding "these figures," that the contract was for a certain sum, and it was not for the jury to state what it should be or anything of that sort, but that they were to take the figures as given to them upon the stand and as they believed them to be correct, adding or subtracting and arriving at the verdict in positive figures. It was held that this instruction did not, as claimed, require a verdict for the plaintiffs for the full sum claimed or for the defendant for the full sum claimed by him, although the jury found for the plaintiffs for the full amount of their claim.

Judgment for the plaintiffs was affirmed.

Ohio Contract with Municipality as to Steam and Water Heating Not Subject to Review by Public Utilities Commission.

On April 26, 1920, the city of Cleveland duly passed an ordinance publishing a price and rate which might be charged for steam and hot water supplied to the city and its inhabitants for five years thereafter. The Cleveland Electric Illuminating Company, then supplying steam and hot water pursuant to a prior ordinance of the city, duly accepted the provision of the ordinance. A complaint signed by more than 3% of the electors of the city was filed with the Ohio Public Utilities Commission, complaining that the rate so fixed was unjust, unfair and unreasonably high, and asking for an investigation. On motion of the illuminating company, the Commission dismissed the complaint for want of jurisdiction. The Ohio Supreme Court, Link v. Public Utilities Commission, 131 N. E., 796, has sustained the Commission's order, holding that where, by virtue of section 4, article 18 of the Ohio Constitution, a valid contract is made between a municipality and a utility company for the product or service of such company to be furnished to the municipality or its inhabitants, the terms thereof are not subject to review by the Public Utilities Commission. Such contract may be entered into by the passage of an ordinance fixing the rate and terms of the designated product and service for a specified period, and by the duly filed written acceptance thereof by the company, and when so made obligates the company to furnish such product or service for the period and in accordance with the terms stipulated in the ordinance.

Importance of Insulation of Steam Lines in Train Yards.

The question of conservation of heat energy in long runs of steam pipe, especially as found on train lines, is a very important one due to the high cost of fuel, labor and maintenance that is evident at the present time. Furthermore, most railroads have a great amount of underground steam pipe which is poorly insulated and in which heavy losses occur, partly due to the fact that some of it runs through wet ground, and especially is this true of the pipes supplying steam heat for trains in the yards and outside offices.

From tests, distribution losses have been found to be about 50% of the total amount of steam required at the boiler plant for heating cars. This is no doubt due to poor pipe covering, defective steam traps and leaky couplings. A saving in the loss of heat from the train pipe line will increase the capacity of the boiler plant, but not to any considerable extent on account of the comparatively high line losses, but with efficient steam heating mains, line losses are not over 10%, which shows that about 40% of the available heat is now going to waste in supplying cars with heat at terminals. It is evident, therefore, owning to the high cost of fuel, that if a good pipe covering is used for this class of service, an enormous saving could be effected.

TEST DATA.

To obtain the most efficient, durable and economical thickness of cover for use on steam train lines, thermal efficiency tests have also been made on different pipe coverings, the tests being made in the laboratory by passing an amount of electrical energy through the heat coils equivalent to a certain amount of heat energy.

From these tests it was found that in all cases a 1 in. covering gives a greater saving over ⅝-in. (for gauge pressures of 50 and 100 lbs. and room temperature of 40° F.), a saving which greatly increases as the wind velocities increase and room temperature decreases. Coverings of 1½-in. did not show a proportionately greater saving over 1-in., due to increased cost of thicker coverings and also because the thermal efficiency does not vary directly with the thickness, being proportionately less the thicker the covering. If the life of the covering is taken for a longer period than 5 years, the saving on 1 in. over that of ⅝-in. covering is still greater, and if less than 5 years, the saving is reduced but in reality the added weight in using 1-in. over that of ⅝-in. covering is small, due to the fact that the cars are standing 75% of the time.

It was also found that a metal jacket increases the efficiency enough to offset the expense of using it, and for coverings without a waterproof shell it should be used as a protection to the covering from outside moisture and mechanical injury. With the heavy waterproof shell on the covering, strong brass bends are all that are necessary.

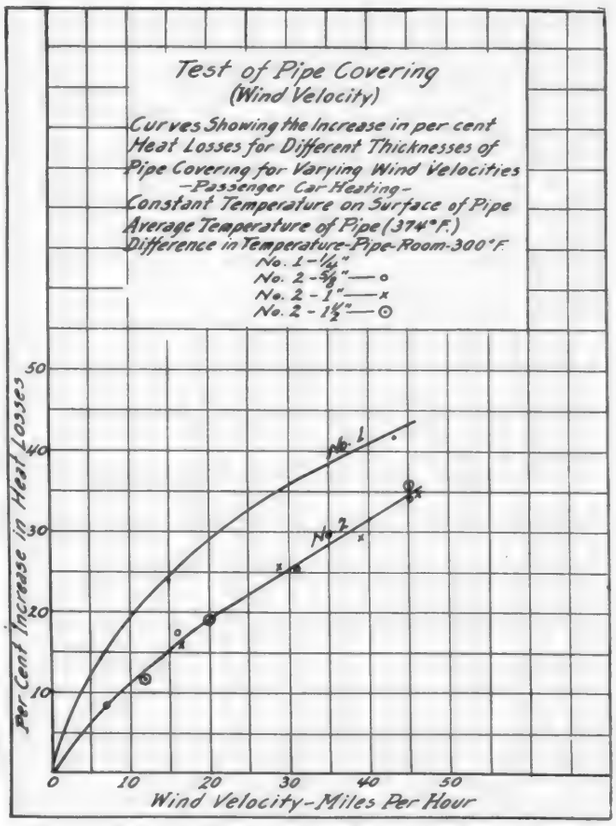
Tests made when the metal jacket was painted white and also black showed no difference in the thermal efficiency, and in any event, white paint under actual operating conditions would soon become discolored. With air circulating around the metal jacket at 3.5 miles per hour the loss in thermal efficiency at 100 lbs. gauge pressure and room temperature of 42° F., was about 14% and at 5.25 miles per hour the loss was only a few per cent higher.

In connection with the tests a mathematical solution was also given so that heat losses might be obtained for steam pipes having varying thickness of covering without going to the expense of testing out the covering. However, this does not entirely eliminate the making of tests, because the conductivity for each make of covering must first be obtained by testing one thickness of each.

With this information in hand, it becomes a question of thermal efficiency and fixed charges in the case of each covering and all pipe coverings can then be purchased on an economical basis as to saving in steam as compared with original cost, durability being also taken in account. It should be remembered that a great difference in thermal efficiency and slight difference in cost might make a considerable saving possible by buying the covering having a higher first cost.

EFFECT OF WIND ON PIPE COVERING

It is often desirable to obtain the increase in heat loss due to the wind blowing over pipe coverings so that in making calculations on pipe covering losses, allowance should be made for the increased loss due to wind.


Test of Pipe Covering
(Wind Velocity)
Curves Showing the Increase in per cent Heat Losses for Different Thicknesses of Pipe Covering for Varying Wind Velocities
—Passenger Car Heating—
Constant Temperature on Surface of Pipe
Average Temperature of Pipe (374° F.)
Difference in Temperature-Pipe-Room-300° F.
No. 1 - 1/4"
No. 2 - 5/8" —o
No. 2 - 1" —x
No. 2 - 1½" —⊙
Per Cent Increase in Heat Losses
Wind Velocity - Miles Per Hour
0
10
20
30
40
50

HEAT LOSSES THROUGH PIPE COVERING WITH DIFFERENT WIND VELOCITIES.

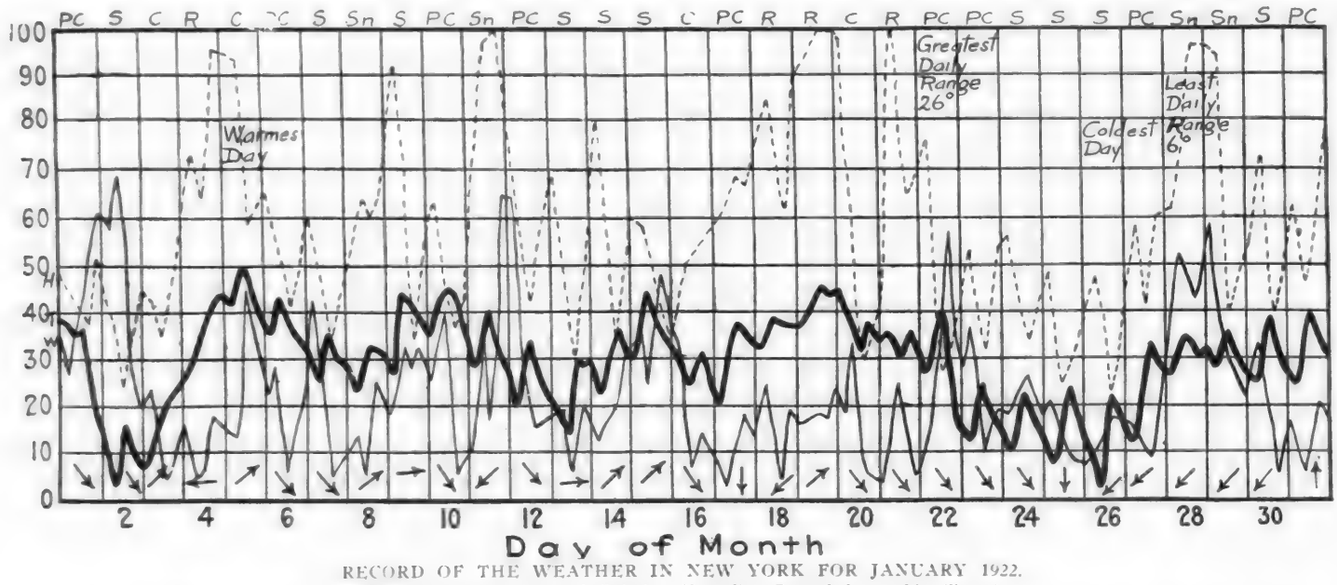
From the curve it will be observed that for coverings ⅝-in. and greater in thickness, the increased per cent in heat loss is the same for all wind velocities from zero to 45 miles per hour, based upon the heat loss for each thickness at zero wind velocity. If the heat resistivity of a covering is known, the loss for any wind velocity can be obtained by adding the per cent increase at the wind velocity as given in the curve. The curve shows that heat losses do not increase directly proportional to the wind velocity, but in a somewhat lesser degree.—T. W. REYNOLDS.

Comparative Cost of Low and High-Pressure Steam.

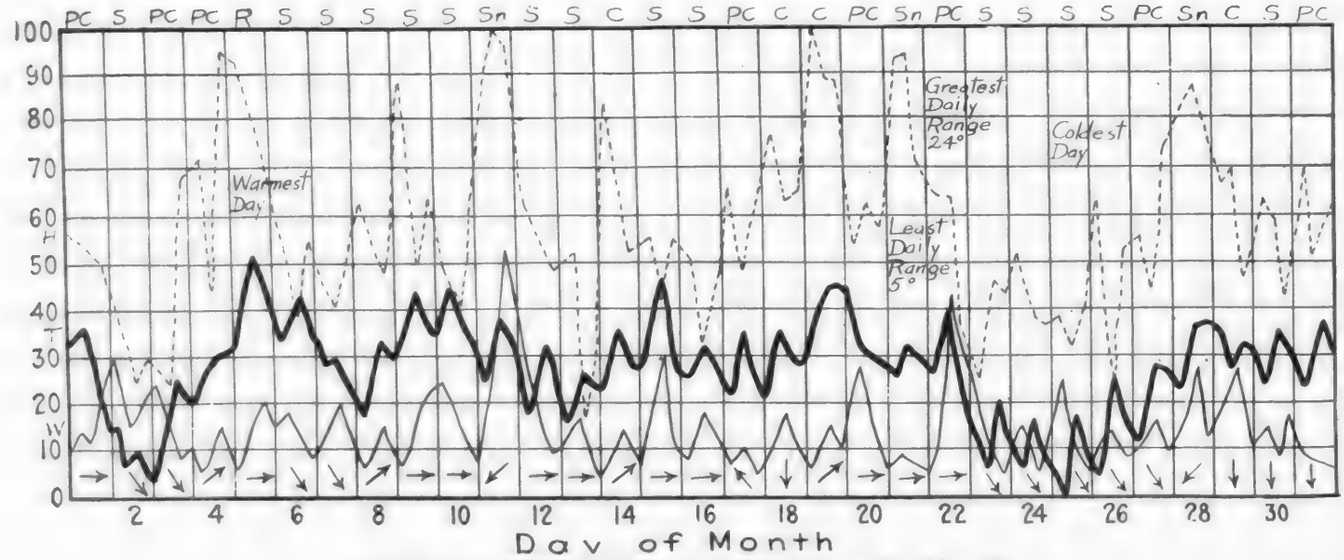
I very often find prevailing among owners and managers the idea that low-pressure steam can be made much more cheaply than high-pressure steam, and they therefore feel that if they could eliminate their engines and turbines and make low-pressure live steam for heating, instead of using exhaust from engines, a great saving in fuel would be effected. As a matter of fact, at the same boiler and furnace efficiency exactly the same amount of fuel is required to supply the same quantity of heat whether the steam is at 1-lb. pressure, at 100 lbs., or any other pressure. The only gain possible might be 1% to 3% better boiler efficiency due to lower flue temperatures made possible by lower steam and boiler temperature.—DAVID MOFFAT MYERS in *Chemical and Metallurgical Engineering.*

THE WEATHER FOR JANUARY, 1922

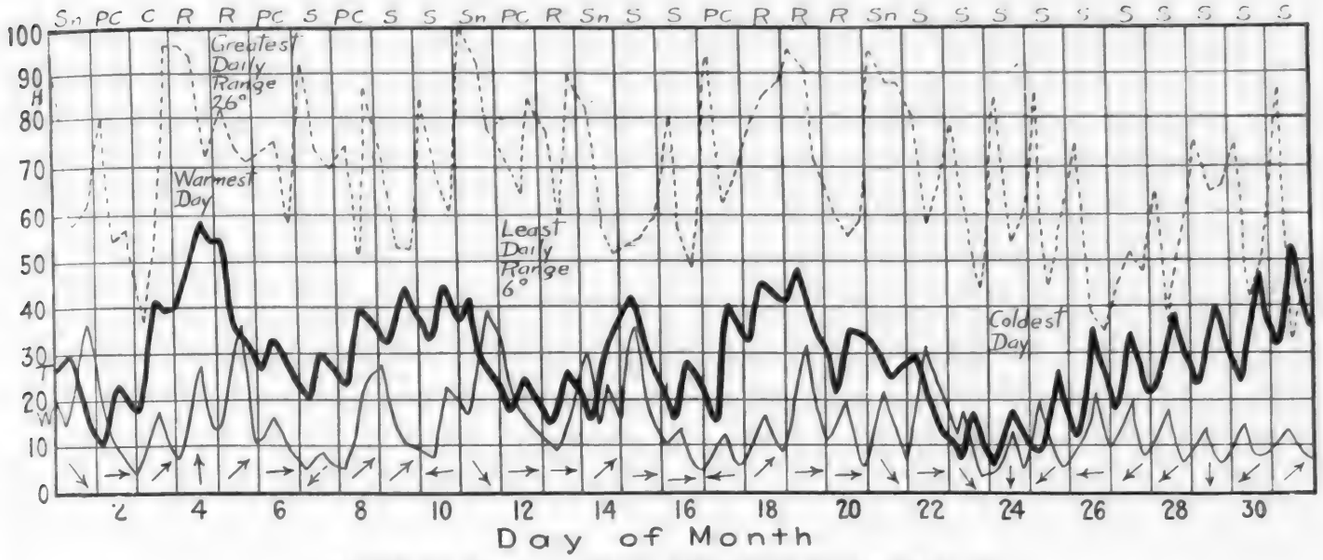
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F	50	51	59	52	61
Date of highest temperature	5	5	4	4	14
Lowest temperature, deg. F	6	0	6	—	3
Date of lowest temperature	26	25	24	22	23
Greatest daily range, deg. F	26	24	26	37	41
Date of greatest daily range	22	22	5	14	14
Least daily range, deg. F	6	5	6	4	5
Date of least daily range	28	21	12	10	18
Mean temp. for month, deg. F	29	27.2	28.8	32.5	30.2
Normal mean temp. for month, deg. F	30.2	27.8	30.7	31.5	30.8
Total rainfall, in	2.46	1.41	1.56	1.16	0.74
Total snowfall, in	9.9	2.7	6.3	2.0	4.1
Normal precipitation, this month, in	3.79	3.82	2.87	2.0	2.27
Normal snow fall this month, in	8.1	11.7	9.0	10.1	—
Total wind movement, miles	13470	8750	8721	9688	8919
Average wind velocity, miles	18.1	10.4	11.7	13.0	12.0
Prevailing direction of wind	N. W.	W.	S. W.	S. W.	N. W
Number of clear days	10	12	10	12	11
Number of partly cloudy days	10	10	6	10	10
Number of cloudy days	11	9	15	9	10
Number of days on which rain fell	5	3	7	2	3
Number of days on which snow fell	4	3	4	7	4
Snow on ground at end of month, in	None	0.2	None	None	None



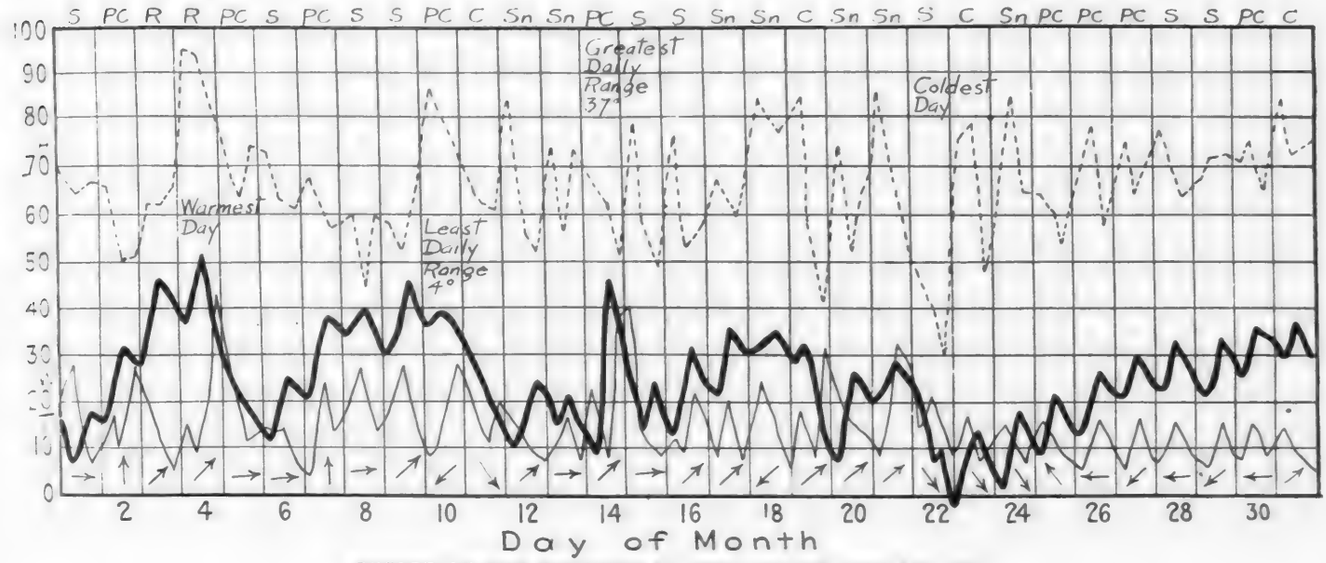
RECORD OF THE WEATHER IN NEW YORK FOR JANUARY 1922.
(Hourly Observations of Relative Humidity Recorded on this Chart.)



RECORD OF THE WEATHER IN BOSTON FOR JANUARY 1922.



RECORD OF THE WEATHER IN PITTSBURGH FOR JANUARY 1922.



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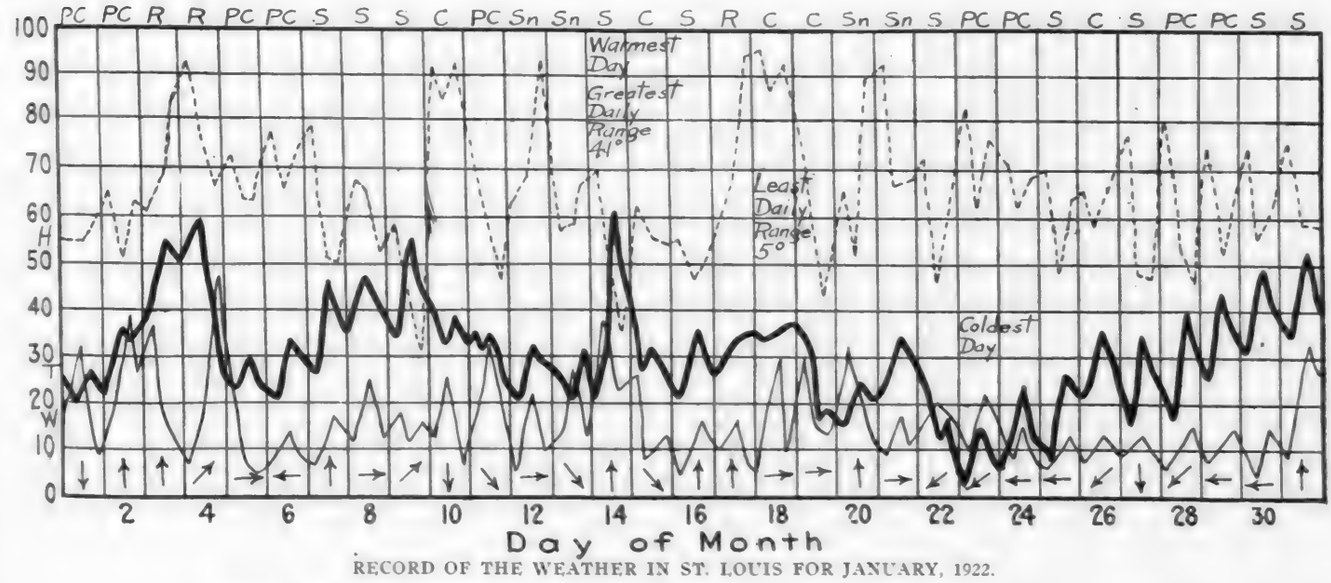

RECORD OF THE WEATHER IN ST. LOUIS FOR JANUARY, 1922.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken line indicates humidity in percentage from readings taken at 8 A. M., 12 M., and 8 P. M.
S—Clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
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Arrows fly with prevailing directions of wind.

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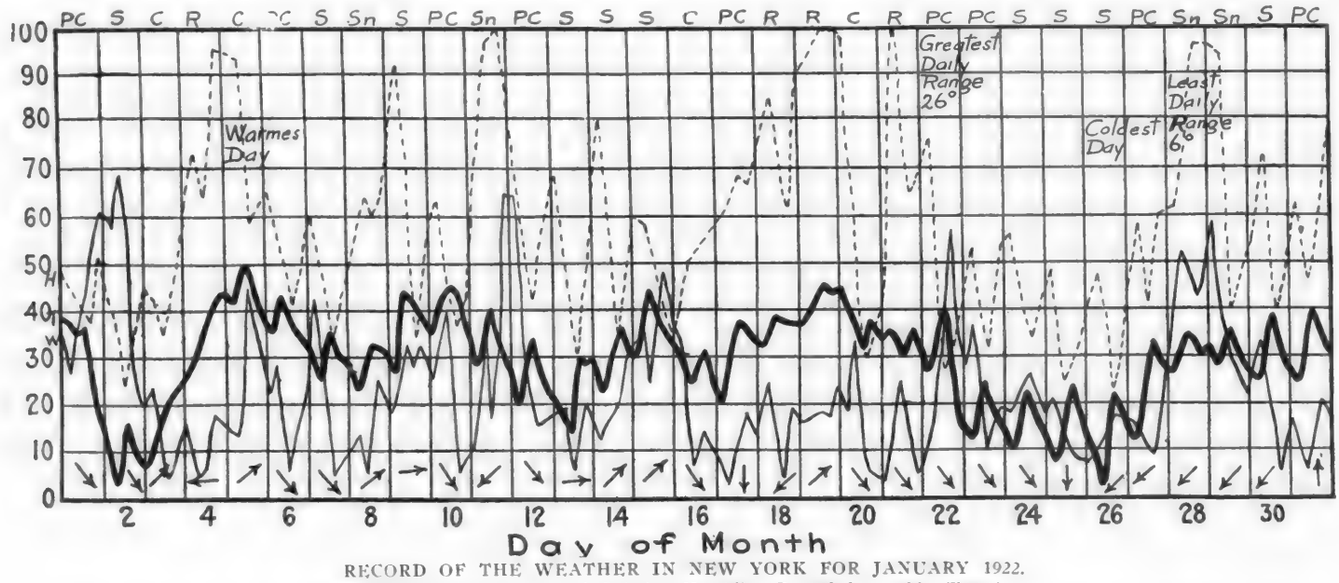

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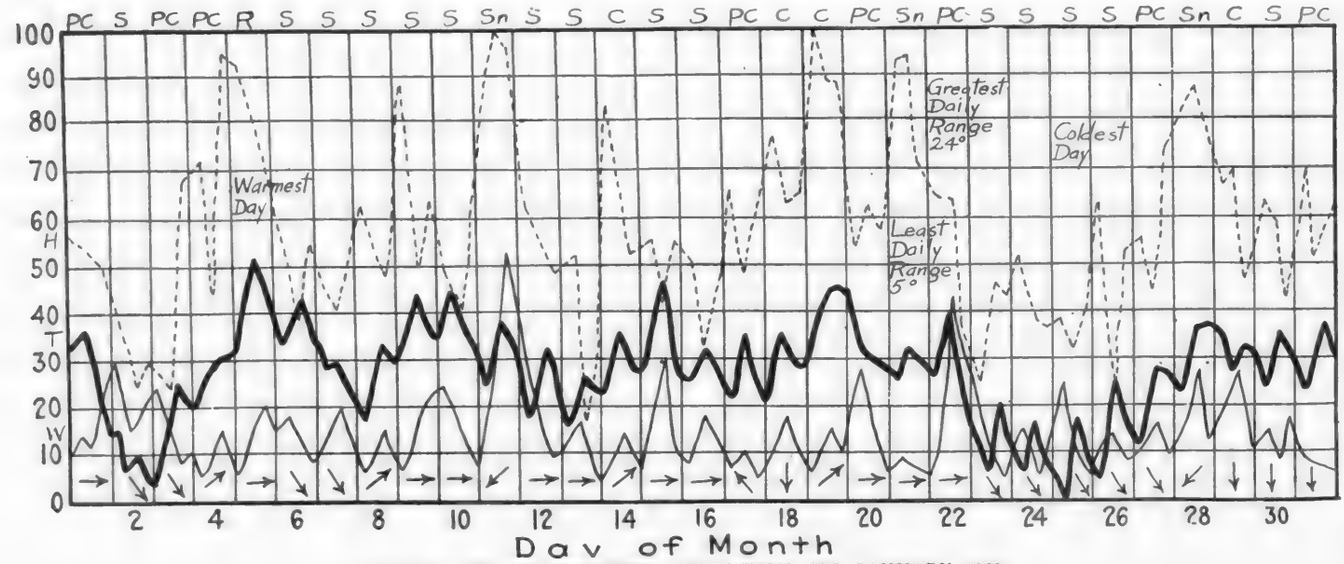

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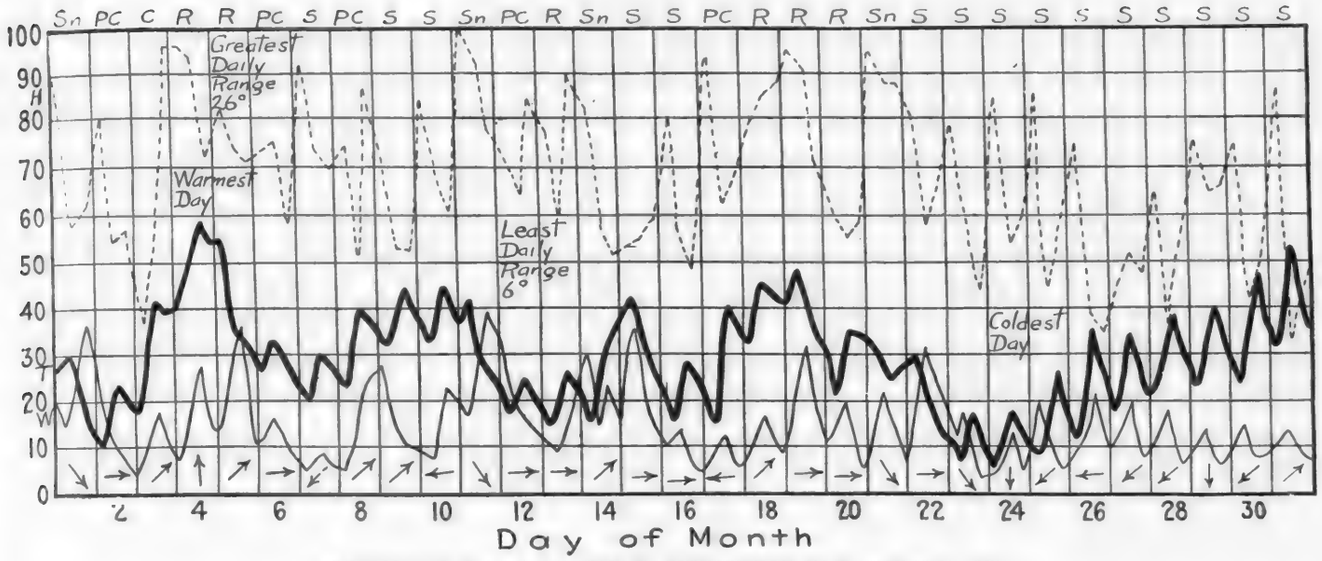
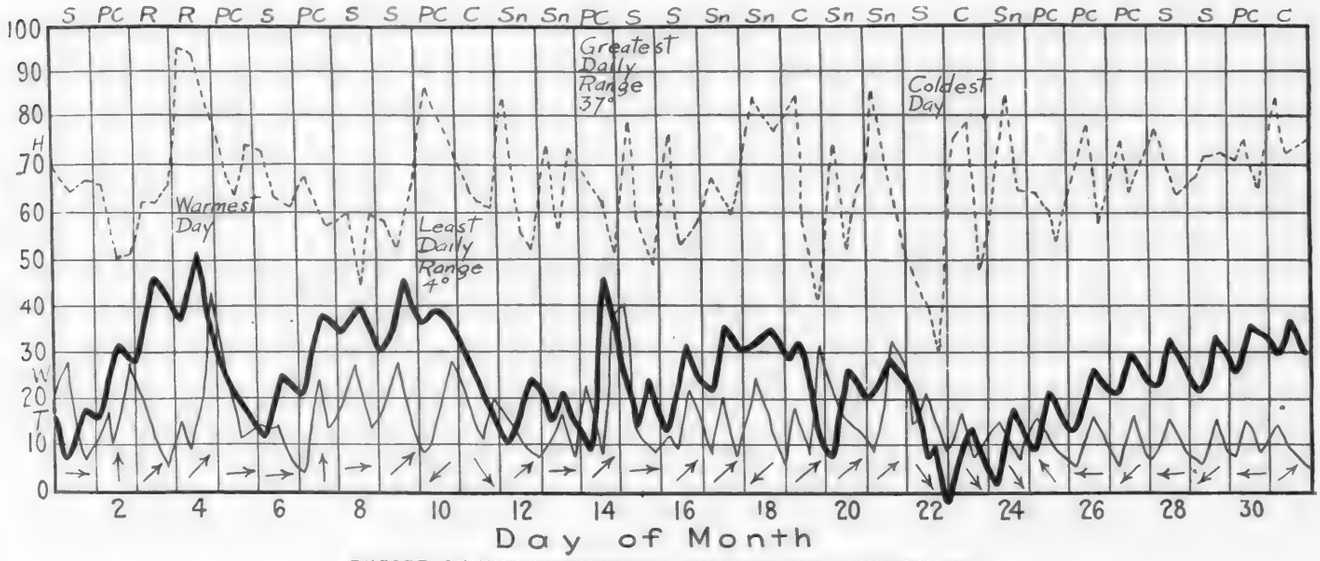


RECORD OF THE WEATHER IN PITTSBURGH FOR JANUARY 1922.



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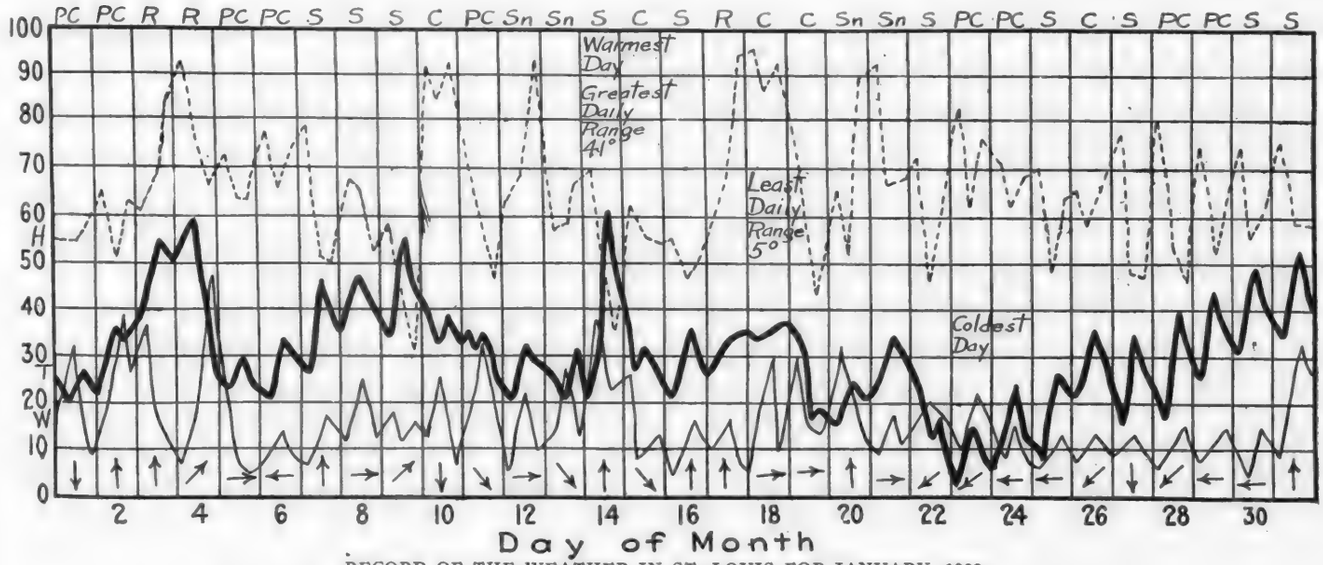

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AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Heating Engineers Considering a Midsummer Meeting in Buffalo and Detroit.

A plan for a midsummer meeting of the American Society of Heating and Ventilating Engineers to begin in Buffalo and end in Detroit was proposed at the recent annual meeting of the society by President C. W. Farrar of the Western New York Chapter. The fact that the new president of the society, Jay R. McColl, is a Detroiter, was advanced as a strong argument for holding at least some of the sessions in Detroit, but the fact that Buffalo has so many industries connected with the heating and ventilating trade was emphasized as a point in favor of that city.

The plan as proposed is to hold the opening sessions in Detroit and then take the night boat for Detroit, possibly holding a session on board ship. Arrangements can be made for reserving as much space on the boat as needed which would give the trip largely the character of one especially arranged for the society.

An informal vote brought out an enthusiastic endorsement of the plan, although the final decision will rest with the council of the society.

Cleveland Chapter Discusses Latest Phase of the Smoke-Abatement Campaign.

James H. Herron, of the J. H. Herron Co., heating and ventilating engineers, was the principal speaker at the January meeting of the Cleveland Chapter, his address dealing with the latest movement for the abatement of the smoke nuisance which is being sponsored by the Community Betterment Council. This organization was established under the Welfare Federation of Cleveland which is composed of some 86 private organizations, in addition to various departments of the City of Cleveland. The campaign as outlined, it was stated, has the support of Mayor Fred Kohler.

In the investigations conducted by the James H. Herron Company, it was stated that the purpose was to determine the amount of solid matter present in the atmosphere from samples taken at a number of stations in different parts of the city. It was considered beyond the purpose of the examination to determine the gaseous impurities and the study was confined to solid contamination only.

Four stations were selected at or near certain hospitals for the collection of the dust. The investigation was planned to last two months, but this was extended to six months. The stations were as located as follows: 1. Roof of the Superior Peanut Company, adjacent to the Huron Road Hospital; 2. Roof of St. Alexis Hospital, Broadway and McBride Avenue; 3. Roof of Babies' Dispensary, 2500 East 35th Street; 4. Roof of Mount Sinai Hospital, 1800 East 105th Street.

The apparatus used was a dust catcher 4 sq. ft. in area, similar to the standard gauge used in the investigation of atmospheric contamination in London in 1914 and 1915. The deposit was collected at the end of each month, carefully filtered out from the water which accompanied it and the residue analyzed for tar, fixed carbon, ash and iron oxide. This follows the order used in the Pittsburgh tests.

The following table gives the tons per square mile per year, computed from the results of the six months' test.

DEPOSIT IN TONS PER SQUARE MILE PER YEAR
July to December, 1920.

	Station No. 1 Huron Rd. Hospital	Station No. 2 Babies' Dispensary	Station No. 3. St. Alexis Hospital	Station No. 4 Mt. Sinai Hospital
Total Deposit	1431.67	903.36	1084.13	353.47
Tar	30.01	19.20	19.09	10.27
Fixed Carbon	431.51	347.83	356.09	114.79
Ash	970.15	536.33	708.95	228.41
Iron Oxide (Fe_2O_3) in Deposit	267.13	198.94	183.72	71.47

It will be noted that the greatest deposit was at stations 1 and 3, both of which were adjacent to the greatest industrial development and traffic. This applies also to the constituent parts of the deposit.

Comparison of the total soot fall in tons per square mile per year with that in other cities gave the following results:

Manchester, England	240	Average
Leeds, England	25-539	
London, England	58-426	
Glasgow, Scotland	1325	Average
Pittsburgh, Pa.	595-1950	
Salt Lake City, Utah	15-980	
(Report made by Bureau of Mines)		
Cleveland, Ohio	353-1432	

It will be noted that Cleveland's dust exceeds that of the other cities named with the exceptions of Glasgow and Pittsburgh. This would indicate, said Mr. Herron, that more care can be exercised in Cleveland and its dusty condition much improved.

Mr. Herron quoted from a report of the Cleveland Hospital and Health Survey by Dr. Haven Emerson, made in 1920, in which he stated: "Cleveland enjoys an amazingly, and one would be tempted to say, an intolerably polluted air all the year round. The reason is not that such air pollution as Cleveland tolerates cannot be abated, or that the similar disgraceful interference with health and enjoyment of life has not been controlled elsewhere."

The economic cost to Cleveland merchants and to Cleveland families, declared Mr. Herron, in the depreciation of stock and furnishings is a tremendous sum; added to this is the cost of fuel wasted in smoke. The total of these items, he said, would more than equal the amount raised each year by the Community Fund.

Sufficient public interest, he concluded, is the only thing needed to measurably abate this great public nuisance. New York has abated the smoke evil more than 50% by the proper instruction in hand stoking. Cincinnati has accomplished 47% abatement since 1914 by the combined efforts of the city's smoke department and the Cincinnati Smoke Abatement League.

Illinois Chapter Awards Prizes for Winning Designs for House-Heating Systems.

Announcement of the winners in the competition conducted by the Illinois Chapter for the best designs of water heating systems suitable for installation in a six-room house was made at the chapter's February meeting, held February 13, at the Chicago Engineers' Club. The first prize of $50.00 went to John N. Hansen; the second prize of $30.00 to L. A. Simonsen, and the third prize of $20.00 to J. H. McCauley. The judges in the contest were Charles F. Newport, E. F. Capron and W. B. Graves.

All of the prize winners were present and were called upon to explain their designs. Besides the winning layouts, four additional plans and specifications were received, the one submitted by W. T. Walters receiving honorable mention.

An interesting discussion followed the presentation of the different plans and the competition was considered a pronounced success. Mr. Newport told of his own method of figuring radiation and he was asked to have mimeograph copies of his rule made for distribution among the chapter members.

Fifty-seven members and guests were present when President J. A. Cutler called the meeting to order. W. B. Crawford was proposed for membership and unanimously elected.

Central Station Heating from a Producer Gas Plant Described Before the Illinois Chapter.

A new scheme for heating an educational institution using a central station producer gas plant and piping gas to various buildings of the institution was described by Samuel R. Lewis before the Illinois Chapter at its January meeting. The scheme included the installation of separate gas-fired boilers in each of the buildings of the group, or, in some instances, having one boiler supply a closely-connected group of buildings. Mr. Lewis

gave figures and the estimated cost of the producer-gas plant in comparison with the steam plant and showed a decided saving in the operation and installation of the producer gas plant.

A committee of the chapter, consisting of Homer R. Linn, chairman; Dr. E. Vernon Hill and H. M. Hart was appointed to act with a number of other bodies in drafting a revision of the present factory laws regarding sanitation, ventilation and illumination, and to work for the passage of these revisions by the legislature.

Another committee, consisting of C. F. Newport, chairman; E. A. May and W. B. Graves, was appointed to secure the adoption by the city of Chicago of the model chimney code recently promulgated by the National Board of Fire Underwriters.

Seventy-six members and guests were present when President Cutler called the meeting to order.

The idea outlined by Mr. Lewis is one that has been worked out on a practical scale and recommended for adoption for a particular institution comprising some 55 existing and projected buildings.

It was not possible, said the speaker, to have a central heating system plant located on the campus proper. A plant of some 2000 H. P. was needed and the pipe lines to the various buildings, it was figured, will total about 10,000 ft., including the main from a power house at the railroad.

The plant is so designed that it can be built in sections. An analysis of the preliminary plans showed that for 55 buildings, the coal consumption, with a boiler efficiency of 65%, would come to 5200 tons per season of 200 14-hour days, and a maximum of 7000 lbs. in any hour. On the basis of 60 cu. ft. for each square foot of equivalent direct radiation for dormitories, gymnasiums and the like, and 40 cu. ft. for each square foot of equivalent direct radiation for buildings that require mechanical ventilation, such as classrooms, library, laboratories, etc., the load is 188,000 sq. ft. of direct steam radiation.

ANALYSIS OF TRANSMISSION LOSSES IF STEAM WERE USED.

Transmission losses, it was figured, when the lines are in perfect order, with no leaks, will require 650 tons of coal during the heating season, in addition to that for the buildings. This figure is based on a heating season of 200 days, of 24 hours each, since the tunnels cannot be allowed to cool so much during any part of a day that the reheating cost will exceed the maintained heat cost.

With steam or water heating, therefore, the transmission loss, under the most favorable conditions, amounts to about 11% of the total fuel when heating the buildings, to say nothing of the losses for stand-by service for buildings like the gymnasiums, used intermittently. There will be serious losses also in the transmission of heat for service water, cooking, laundry purposes, etc., which from experience, said Mr. Lewis, are unaccountably high.

Allowing 2600 ft. as the distance from the power house at the railroad to the tunnel in front of the chapel, the university would require about 10,000 ft. of tunnel. The size would vary from 10 ft. wide to 7 ft. wide and 7 ft. high inside. The steam mains would range from 12 in. to 2 in. in diameter, with an average return of about 6 in.

It was figured that the tunnels would cost on the average not less than $35.00 per linear foot, complete, at present prices, since there would be some rock excavation and the plans would call for 6-in. reinforced concrete walls and double-thick magnesia insulation. This gives a total of $350,000 for transmission lines.

DETAILS OF PRODUCER-GAS PLANT.

After giving figures for the annual cost of a steam plant, Mr. Lewis presented the details of his proposed producer-gas generating equipment, to be located at the railroad, with ordinary gas mains running to each building and gas-fired automatic cast-iron boilers in each building to do the heating with steam or water, as may be desired.

A gas plant would require a large supply of cooling water and this, he showed, is available at a nearby creek. He figured that the cost of the individual boilers in the various buildings would be offset to some extent by the saving of pressure regulators and traps required by a steam plant.

The greatest saving, however, would be in the elimination of the tunnels. Since there would be practically no transmission loss, heat for summer uses could be furnished from the large gas distributing mains and the gas generators could be operated in proportion to the load by having several units of varying capacity. Cast-iron pipes buried in the ground could be used for transporting the gas. Several of these, side by side, could be installed as the load grows. As for electricity, this, he said, could be generated with gas engines at a comparatively low unit cost.

Producer gas, said Mr. Lewis, is comparatively bulky, about four times being required to do the same heating as with natural gas.

It is clean, however, and can be used for cooking as well as for heating, and can even be used for illumination when Welsbach mantles are installed. On account of its bulk, it is not practicable to store the gas in holders.

With the gas plant, said Mr. Lewis, it may be desirable to install in the power house a small electric generating plant, gas-engine driven, for power purposes in running the various pumps, fans, etc., particularly as the heaviest lighting load will come during the evening, off the peak heating load.

One of the precautions pointed out by Mr. Lewis was that as the products of combustion from the gas heaters in the various buildings would carry a considerable water content, chimneys serving them should have cast-iron linings.

The proposed gas plant would consist of three gas-generating, cleaning and pumping units, each capable of supplying approximately 230,000 cu. ft. per hour. To supply steam to the engines driving the gas pumps, a steam boiler plant of 3000 sq. ft. would be required. The boilers and gas-generating plant would be housed in one building for convenience of supervision and operation. Mechanical coal-handling would be required on account of the height to which it is necessary to raise fuel to the producer coal feeders. This coal-handling plant would be extended to supply coal to the boilers, thus reducing manual labor. With a high-grade producer plant of the size required, said Mr. Lewis, an efficiency of 75% from coal to cool, clean gas delivered at 1 lb. pressure is readily possible and with gas heater for steam or water, he said he had verified an efficiency of 80% from gas to steam.

TABLE I. ANNUAL CHARGE FOR A STEAM PLANT.

Fuel (5,850 tons at $6)		$35,100
Transmission lines, cost $350,000		
Boiler plant, 20,000 sq. ft., including auxiliaries	100,000	
	$450,000	
Interest and sinking fund, 10%		45,000
Upkeep on boilers and piping, 5% of $200,000		10,000
Annual Cost		$90,100

The total heat loss from the buildings, on which the coal requirements for the steam plant were based, is 47,000,000 B. T. U. per hour. At 75% efficiency of the gas boilers and 75% efficiency of the gas producers, 5,200 tons of coal per season of 200 days would be required. In addition to this fuel consumption for the gas plant, coal must be burned for the gas pumps and the exhaust steam used in connection with the process. This power demand adds 857 tons of coal per season, or a total for the gas plant of 6,057 tons.

TABLE II. ANNUAL CHARGE FOR GAS PLANT.

Fuel (6,057 tons at $6)		$36,342
Transmission lines (gas mains)	$50,000	
Producer plant		
Three 14-ft. producers	$106,000	
Three 1,000-sq. ft. boilers	15,000	
Pumps and cooling towers	15,000	
Piping	7,500	
Foundation and tank	8,500	
	$152,000	
Excess cost of boilers in the various building over regulators and traps	75,000	
	$277,000	
Interest and sinking fund, 10%		27,700
Upkeep on plant and boilers, 5% of $227,000		11,350
Annual Cost		$75,392

Comparing Tables I and II, the annual charge for the gas plant seems to be some $14,700 less than that for the steam plant. For plant investment it will be much easier to raise $277,000 than $450,000.

Unless these figures deceive, an exceptionally inefficient gas plant would be permissible so long as good heating service was rendered. The following comparison is interesting:

Annual cost of steam plant.....	$90,100
Cost of gas plant without fuel being merely the overhead.....	39,050
	$51,050

The difference between these two items is $51,050, being what is left to buy coal for the gas plant from a steam-plant appropriation. This would buy 8,508 tons at the $6 price, or nearly half again as much coal as the gas plant will require.

St. Louis Chapter Discusses Fans and Their Application.

A lecture on "Fans, Blowers and Their Application," by H. E. Sproull, was the feature of the January meeting of the St. Louis Chapter, held January 19 at the City Club. The lecture was illustrated by lantern slides and covered the development of fans from the earliest types. Among the early applications described were those in which individual pipes were used, especially in hospital ventilation.

The speaker then took up modern applications, including views of lead smelting works before and after the application of fans to reclaim the fumes which were despoiling the surrounding land.

Previous to the main address of the evening President William C. Sodemann announced the following committees for the year:

Membership: V. D. Rossman, chairman; W. Keiser, Thos. J. Hester.

Entertainment: R. K. Milward, chairman; A. L. Haller, L. J. DeNeille.

Chapter Relations: E. S. Hallett, chairman; E. P. Bradley, W. G. Hooper.

Publicity: W. Klein, chairman; Henry Hammer, G. H. Nader.

Program: L. Walter Moon, chairman; H. E. Sproull, A. H. Vogel.

Legislation: E. B. Langenberg, chairman; G. W. Cooper, A. H. Riley.

Charles K. Foster, vice-president of the American Radiator Company, who was present, was called upon and he responded by emphasizing the growing importance of heating and ventilating in the mechanical arts.

Western New York Chapter Discusses Modern Methods of Vapor Heating.

Charles V. Haynes, the new vice-president and sales manager of the Hoffman Specialty Company, was the principal speaker at the February meeting of the Western New York Chapter, held February 7 at the chapter's club quarters in the Iroquois Club. His subject was "Modern Methods of Vapor Heating." He was introduced by George D. Hoffman, president of the company, who told of his own long connection with the development of vapor heating.

In the absence of President Farrar who was in Detroit addressing the Capitol Club, the meeting was in charge of Vice-President George H. Drake, with 70 members and guests present.

Hugo Hutzel gave an interesting report of the annual meeting of the society in New York and also discussed the plans that have been adopted to promote better chapter relations. O. K. Dyer, chairman of the membership committee, reported on a membership campaign which will be launched shortly.

In discussing the forthcoming "Guide" of the American Society of Heating and Ventilating Engineers, it was urged that each member acquaint himself with this publication and give it his full support.

Following Mr. Haynes's talk, a number of the members and guests engaged in a discussion of the subject. Due to the lateness of the hour, a paper by O. K. Dyer was held over to another meeting.

New York Chapter Hears Addresses on Air Recirculation and Ozone

Further light on the subjects of air recirculation and ozone for ventilating purposes was furnished at the February meeting of the New York Chapter which was held February 20 at the Building Trades Club. Norman A. Hollister, an engineer of the American Blower Company discussed the recirculation ventilating system as installed in the Springfield Y. M. C. A. Training School and which came in for so much notice at the time of the tests that were made of the system in 1913.

These tests, it will be recalled, were made by Professor George C. Whipple and Melville C. Whipple and were discussed in THE HEATING AND VENTILATING MAGAZINE for September, 1913. It was pointed out at the time that the installation afforded an opportunity of studying a new phase of the problem of air washing, namely that of purifying air that had passed through an occupied room. The gymnasium was supplied with air from a ventilating plant provided with an air washer operated at such a rate that the air in the room was changed every nine to twelve minutes. The plant was so arranged that air could be taken from the outside and washed or the exhaust air from the room could be returned through the washer and again delivered to the gymnasium. Comparison was thus made between the use of outside air and rewashed air.

It was noticed that when the exhaust air left the gymnasium, it had a noticeably sour and musty odor. After passing through the washer this was almost completely removed and the returned air was fresh and sweet. At the same time the "gymnasium odor" was acquired by the washer water and could easily be detected in the sample bottles. The washer water was also found to contain large numbers of bacteria and animal matter given off from the skin of the men exercising on the floor. Dust, bacteria, moulds, nitrogen and iron were removed from the indoor air by the washer to an extent averaging over 50%.

The results indicated that under the conditions there existing the exhaust air could be washed and returned to the gymnasium with entire safety and comfort to the occupants of the room and with no apparent sacrifice of wholesome properties. The carbonic acid was not reduced by the air washer. The conclusion was reached that the recirculated air after washing was cleaner than unwashed outdoor air, but was slightly less clean than the outdoor air after washing.

In his address Mr. Hollister gave the impressions gained by a recent inspection of the plant which, he stated, is still being operated along the same lines as when first installed, that is, recirculating the air. Speaking of the large air volumes being handled, he said that this was counterbalanced to a large extent by the fact that the occupants were vigorously exercising. In response to a question as to infiltration of outdoor air through the window cracks and at other points, he said no attempts had been made to determine this infiltration, but there must be considerable, otherwise the moisture content of the recirculated air would eventually reach the saturation point.

Recent developments in the ozone situation were presented by Henry Hamilton, New York manager of the Ozone Pure Airifier Company. Mr. Hamilton dwelt on the renewed interest in this subject occasioned by the St. Louis tests, and, more recently, the tests conducted in Chicago. He presented some interesting points on the care and operation of ozone units. In the ensuing discussion the effect of ozone on air ducts was taken up, the point being made that ozone causes pitting of galvanized-iron ducts. Mr. Hamilton stated that this may have been so with high concentrations of ozone but with those at present used and advocated, there was no trouble on this score.

The meeting was in charge of a committee headed by Arthur Ritter.

Relation of Labor Cost to Total Cost of Six-Room House.

The following figures have been compiled by the Division of Building and Housing of the Department of Commerce, to show the percentage which the amount paid to each labor group bears to the total labor cost of a six-room house:

Total Labor Cost 100%

Trade.	Frame house.	Brick house.
Carpenters	49.6	32.2
Bricklayers	6.2	21.5
Hod carriers	2.2	6.7
Plasterers	7.9	8.8
Plumbers	8.7	7.6
Electricians	2.6	2.5
Painters	10.0	6.3
Common laborers	6.3	9.9
All others	6.5	4.5
Total	100..0	100.0

These averages were constructed from reports covering a large number of six-room brick and frame houses throughout the country.

The relation of the amount paid to the various groups to the total labor cost varies according to the types of construction prevailing in the various localities; however, these averages give a fair view of the general distribution of labor costs.

NATIONAL DISTRICT HEATING ASSOCIATION

Plans for Annual Meeting.

Announcement is made that the next annual meeting of the National District Heating Association will be held at Cedar Point, O., June 20-23, 1922, with headquarters at the Breakers Hotel. This matter was decided at the mid-year meeting of the association's executive committee, which also discussed the program for the meeting.

As a part of the program it was decided to ask all of the standing committees to prepare reports for the convention. These will cover the work of the committees on Public Policy, Station Operating, Rates, Heat Utilization, Meters and Accessories, Underground Construction and Heating Research. The Rules and Regulations Committee was instructed to compile a new form-book, bringing it up to date. The Meter Committee was instructed to cover the maintenance of flow meters. The Underground Construction Committee was instructed to cover welded pipe in the ground and to report on insurance rates on pipe welding, using photographs and lantern slides, if necessary, in their report.

Among the papers arranged for is one on "Superheated Steam as Applied to Steam Heating," to be prepared by R. D. DeWolf, of Rochester, a former president of the association; and one on "Methods and Value of Plant Interconnection in Heating Work." In addition, it was decided to have a "Round Table" or symposium on new appliances and new methods and the secretary was instructed to invite manufacturers to present new appliances and the central station men to present new methods at one of the regular sessions.

A proposal to raise the annual dues of members whose gross income exceeds $100,000 led to the appointment of a committee composed of D. S. Boyden, F. B. Orr and Secretary D. L. Gaskill to make a survey of the member companies and also to draw up a budget of the association's annual needs.

Prize Offered for Best Central Station Heating Records.

Through the offer by one of the member companies of a prize of $50.00 for the best records, forms, blanks, etc., used by an operation company, the National District Heating Association has inaugurated a competition with a view of developing a better general form for the use of the association.

According to the details of the competition, as announced in the *Bulletin* of the N. D. H. A. for January, the data must include:

1. Records of connected radiation and cubical contents.
2. Records of meters, their settings and readings.
3. Traps and regulators, their care and inspection.
4. Coördination of records with company's bookkeeping.
5. Record of service and connected load.
6. Records of connected load to street mains.

The awarding of the prize will be in the hands of a committee consisting of J. L. Hecht, F. B. Orr and W. J. Kline, and will be made at the next convention of the association.

Such forms, or records, should provide for those items that are necessary for the guidance of the operating manager in the conduct of his heating system, or for the engineer who is called upon to make valuations for rate determinations or other purposes. The form relating to station performance, for example, might provide for keeping record of coal burned, its cost, evaporation obtained, relation of charges between electric credit and steam charges, etc. The form relating to a given heating installation might provide for keeping record of connected radiation in the building, condensation per square foot of connected radiation, cubical contents connected to each main, size of service and load connected, kind of system served, rate charged, etc.

The New Central Station Heating Handbook.

An achievement of immense importance to the central station heating industry is formally brought to the attention of the engineering world in the announcement that the first edition of the "Handbook of the National District Heating Association" is now ready for delivery. This work represents the results of many months' effort on the part of the association's Educational Committee, under the chairmanship of J. H. Walker, of Detroit, now the president of the association. While designed especially for those interested in district heating, its contents, as will be seen, make it of hardly less interest to the heating profession generally.

Starting out with data on steam generation, there are data sheets ready or in course of preparation on buildings and fixtures, fuel and ash-handling apparatus, stokers, furnaces and brickwork, boilers, chimneys and breechings, pumps and piping, heaters and purifiers, and instruments and gauges. These are followed by what will eventually amount to some 500 sheets on steam distribution, with special reference to piping, conduits, tunnels.

Utilization is allotted 400 pages, divided into consumers' equipment, consumption, and economical utilization. Some 300 pages are allotted to meters, including condensation, steam and water types. This matter is followed by data sheets on water heating, while the concluding sheets will be devoted to consumers' installations and miscellaneous data.

Although the first edition of the Handbook contains only a fraction of the total number of data sheets necessary to cover the various subjects mentioned, the entire scope of the work is given because the association takes pains to state that purchasers of the Handbook will be entitled free to additional data sheets as issued until the entire series is completed. Those appearing under "Distribution," for instance, in the first edition, cover some 20 topics, while those coming under "Utilization" embrace some eighteen different subjects. One series which is especially well compiled is devoted to "Cost of Heating Buildings," by George W. Martin. Other sheets show the amount of steam used in restaurants, kitchens and laundries.

The Handbook is bound in a six-ring black leather binder, with gilt lettering. The sheets themselves are of uniform size, 3¾ x 6¾ in., while the Handbook, as made up, measures 4¾ x 7 in. Pp. in first edition, 192. Price $5.00. Published at Greenville, O., or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

Annual Convention of Associated General Contractors of America.

A definite assurance that construction recovery is under way and that it is the first phase of a general business revival sums up the results of the construction conference held in Cleveland, January 17 to 19 by the Associated General Contractors of America. Evidence of this fact, both statistical and informal, abounded in the discussion of the delegates and in the papers presented as a part of the program.

Col. Leonard P. Ayres, who was chief statistical officer of the A. E. F. and who is now vice president of the Cleveland Trust Co., expressed the belief that prices will continue to fall, intermittently, for ten or twenty years more, but conveyed assurance that the construction industry will be immune to many of the embarrassments of the coming period, because it supplies a market in which there is a latent demand equal to 2¼ years normal production of building.

"In other words," said Col. Ayres, "construction can go along for nine years at 25 percent above normal and only fill the normal demand by the end of that time.

Col. Ayres said that building finance problems had commenced to adjust themselves, through greater abundance of money. "The acrimonious discussions between yourselves as contractors and ourselves as bankers are about over," he remarked. "Within six months so much money will be for borrowers that owners will be able to arrange building loans on pre-war terms."

Charts shown by Col. Ayres indicated a sub-normal volume of building for every year since 1912. Even the apparent large building figures for 1919 and 1920 were only apparent, he declared. The cost was large but the building was far behind even the current needs of the time. The only time in the last nine years when the volume has gone above average requirements was for the last few weeks of October, 1921. This was chiefly residence building, but it shows in Col. Ayres opinion that the tide is rising rapidly. He declared that building prosperity is always the first phase of general revivals and that it disseminates prosperity more widely than any other type of activity.

J. Park Channing of Boston, who succeeded Herbert Hoover as chairman of the Federated Engineering Organizations, gave the major paper of the conference on the subject of waste elimination and said that 25% of the responsibility for waste rests on labor, 50% on management and the remaining 25% on outside relationships. In respect to industrial accidents, however, he asserted that 85% of the responsibility rests on the individual workman.

F. L. Cranford of New York, former government director of the Muscle Shoals nitrate plant, discussed a 20,000 mile trip taken by officers of the association in the interest of construction revival. He expressed the opinion that labor has reached pre-war efficiency and that the chief retarding factor is the general belief that material is too high, "particularly materials controlled by national associations that meet behind closed doors."

Cost-plus contracts, fee contracts and efforts made in some projects to eliminate the general contractor were discussed. D. A. Garber of New York voiced the belief that few architects and engineers can qualify to direct a building project in the place of the general contractor. Godfrey Edwards of Los Angeles decried anything but lump sum contracts, believing that when a builder takes a job on a cost plus or a fee basis, he is paving the way for his own elimination.

The conference acted favorably on the Kenyon bill, to create a reserve fund that will stimulate construction in depressed periods.

Otto T. Mallery from the Department of Commerce, urged that 10% of all public construction funds be set aside in such a reserve, each normal appropriation for that year.

Other speakers at the convention were Ernest T. Trigg, of Philadelphia, President of the National Federation of Construction Industries, whose subject was "Coöperation in Construction," and Col. Evan Shelby, New York Attorney, who was formerly legal advisor to the construction division of the army, who spoke on "Organization in Construction."

"The opportunity before the construction industry is very great," Mr. Trigg said, "if and when the public's confidence is secured.

"We have passed the stage when the employers and the employees can get together with themselves and with each other and determine the affairs of the third party, the public. The public has come back into its power.

"But, until we come to where the public's confidence is restored, construction is not going to revive."

The obligation rests with the leaders in the construction industry to clean house, Mr. Twigg emphasized. They must, he said, see that the customs of the trade which hold up costs and neutralize the effects of competition, be done away with. They must also, he said, take the initiative in promoting more cordial and economical relations with their workmen.

"You must not take advantage of the fact that now you have the whip hand." Mr. Trigg asserted. "By taking the broad view of things right now, you will bring about a condition of peace in industry where both you and your employes will share in ungrudged prosperity."

Distribution of Building Costs.

The proportion of each item that goes to make up the cost of an industrial building is shown graphically in the accompanying chart, drawn by Monks & Johnson, architects and engineers.

Five of these items—namely, engineer's fee, contractor's overhead, contractor's profit, insurance, and plant rental—fluctuate but slowly, and that only as the cost of commodities in general rises or falls, or as they are directly affected by the remaining three items of the chart.

Labor—Wages of artisans employed in the building trades gradually rose from December, 1913, to a peak in May, 1920, and from that peak they have descended not more than 15%. But the efficiency of labor, which had fallen as wages rose, has returned to that which obtained in 1914. This is due primarily to the scarcity of work. As a result of this increased efficiency the cost of labor on buildings has probably fallen 50% from the peak of the war period. Further reductions in wages will eventually be made, but this change can only be gradual.

Material—The price of materials depends upon the cost of production and demand. The demand for building materials has been so small during the last twelve months that it is probably true that, in order to stimulate the market, materials have sold at a price leaving the manufacturer and dealer no profit, and in some instances have probably been sold below what it cost to produce them. The price quoted in the open market for building materials would not indicate that these sacrifices had been made, but contractors have recently been able to buy at prices far below market quotations. The cost of production is therefore not an important factor at this moment and in any event is likely to change but slowly. From this analysis of the market it would seem that no substantial drop in prices will occur during the new year, but that the seasonal demand likely to occur in the spring will undoubtedly cause a stiffening of prices.

Freight—There is some talk of a reduction in freight rates, but a cut of 20% in this item would result in a decrease of less than 2% in the cost of building. It is true that a reduction in freight

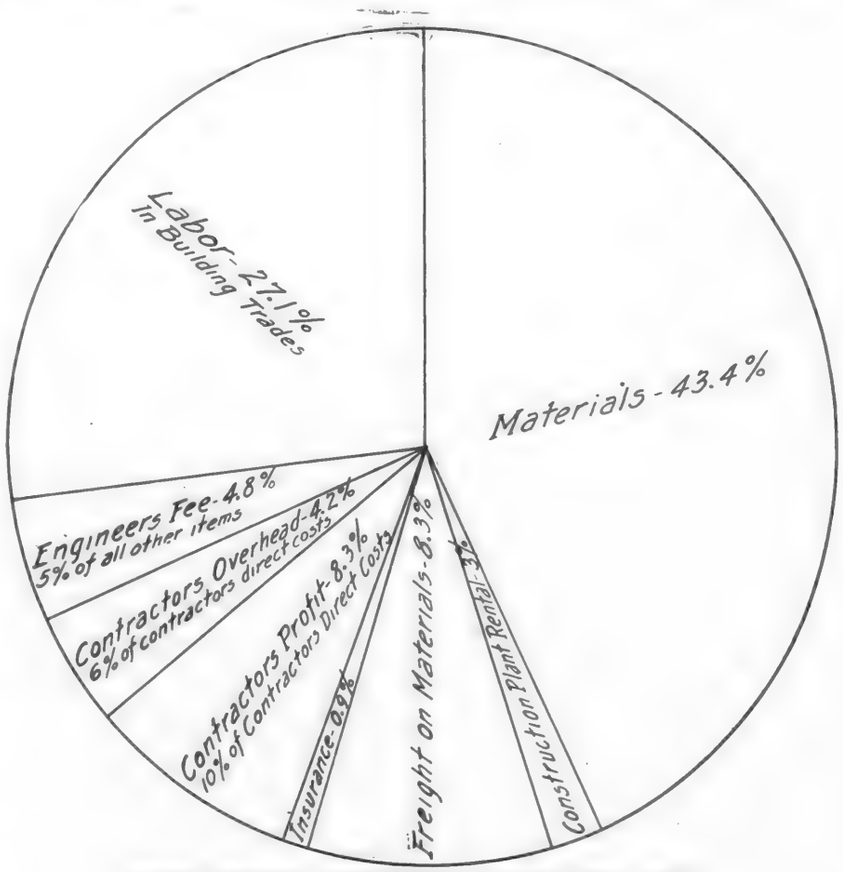

Labor - 27.1%
In Building Trades
Materials - 43.4%
Engineers Fee - 4.8%
5% of all other items
Contractors Overhead - 4.2%
6% of contractors direct costs
Contractors Profit - 8.3%
10% of Contractors Direct Costs
Insurance - 0.8%
Freight on Materials - 8.3%
Construction Plant Rental - 3%

CHART SHOWING DISTRIBUTION OF BUILDING COSTS.

rates will also affect the cost of materials and indirectly thus reduce building cost, but it would be some time before such indirect benefit would be felt by the builder.

From the foregoing, Monks & Johnson conclude that the cost of building now is as low as, or lower than, it will be at any time this year.

Practical Measures Recommended to Keep the Sheet-Metal Work as Part of the Heating Contract.

In analyzing the causes of the tendency to separate the sheet metal work from heating contracts, Walter L. Fleisher, of New York, president of W. L. Fleisher & Co., suggests in the *Official Bulletin* of the Heating and Piping Contractors' National Association for February that:

"My idea of the proper way to preserve the business and profits of the sheet-metal end of the heating business for the heating contractors is for groups of men not having sheet-metal shops to establish a certain number of shops belonging to the individual members, who can own stock in these shops in varying amounts, the profits from which shops would accrue to the men putting in their money, each shop to serve enough shops to make it profitable to equip them with modern machinery and to employ adequate superintendence and men.

"In other words, say that in connection with heating work in Brooklyn a million dollars' worth of sheet-iron work was sublet to sheet-metal shops a year. The probabilities are that this sheet-metal work is let to three or four sheet-metal shops. Why should not Brooklyn groups of steam contractors either buy up the shops with which they deal and run them as co-operative sheet-iron shops or establish a similar number of shops of their own.

"For instance say out of thirty men, six men would own one and twelve men own another, etc., as the volume of their work required sheet-metal. These shops could be run by independent superintendents; the heating contractor would not have to put a margin of profit on his sheet-metal work, as he would obtain a profit from the profits of the sheet-metal shop. In other words, if the work that one particular man could give to the shop would only require a fifth of the output of the shop his overhead in connection with that shop would only be one-fifth of the total. Of course, this shop could take independent work when there was no heating work and would be in the same position as an independent shop.

"To the objections that might arise that this would tend to eliminate competition, I feel that the answer is obvious; that the sheet-metal is only an adjunct of the heating business; that it is only a small portion of the heating business and that the sheet-metal work, except in rare occasions, would not swing the job; that in nine out of ten cases, the heating contractor figuring on a heating job having a large amount of sheet-iron gets a price from all of the independent bidders and that each heating contractor in figuring on a job uses the same sheet-metal figures; i. e., the lowest of the independent shops.

"I do not believe that refusing to figure on heating work in which sheet-metal is let separately either is a fair or an economically sound proposition. There are always many people who would figure on the heating work without the sheet-metal, which fact would inevitably upset such a plan of procedure. There is only one way of selling anything consistently and that is to offer greater value for the same amount of money or the same value for less money. Consequently, we must be in a position to combat dollar for dollar the independent sheet-metal shop or we must bring a greater knowledge of our work than the independent sheet-metal shop can. In many cases, where we are objecting to the sheet-metal work being let separately from the heating contract, the sheet-metal is designed by consulting engineers with a thorough knowledge of the work that they design, and it is doubtful whether in such cases we can or will ever be able to bring a greater knowledge than they have to our work.

"We are, therefore, in the position of having to sell at the same or less price than the independent shops and to do that we must establish our own shops to take care of our work. If we did that, we could get a better price for the sheet-metal than the independent shops, because other things being nearly equal, it is my opinion that the owner or contractor or architect would infinitely rather have the heating and sheet-metal work let under one contract as long as he did not feel that he was paying two profits.

Owner Not Qualified to Testify as to What is Necessary to Remedy Defects in Heating Plant.

The Texas Court of Civil Appeals holds, Munn v. Brillhart, 230 S. W. 862, that when a heating system installed for the owner of a house did not comply with the warranty given by the contractor, the owner was entitled to recover the reasonable cost of remedying the defects so as to make the system fulfill the contract, in the absence of evidence to show that the plant could not be used to advantage after the correction of defects. But if the owner makes expenditures to remedy the defects, he must, before he can recover the amounts paid, show that there was a necessity for incurring the expense and that the amounts paid were reasonable.

In the present case the plaintiff owner, who sued the heating contractors and their surety on the warranty of a water heating system, testified that, after failure to get the defendants to do anything under the contract, he talked to several contractors, and had a master plumber go over the system and make recommendations of what was required; that he then got bids for the completion of the work and let a contract therefor; that the reasonable cost of work that was necessary to be done and that was done to make the job according to contract, was $690. The plaintiff testified that he was not himself qualified to say what was necessary to be done to remedy the defects, but was qualified to testify as to the reasonable cost of the work that was actually done. It was held that, since the plaintiff was entitled only to recover the reasonable cost of what was necessary to remedy the defect, and it was shown that he was not qualified to give his opinion upon what was necessary to make the heating plant do the work, the admission of his testimony that it was necessary to expend the $690 upon the plant in order to make it come up to the warranty, was error. Judgment for the plaintiff was therefore reversed and the cause remanded.

Limitations of the Activities of Trade Associations.

Information lawfully secured regarding trade and economic conditions made public for the information of everyone can not be harmful. Information secured solely for the benefit of members and of a character that puts the membership, by reason of the information, in a position of advantage as compared with the public without such information can not be sanctioned by sound public policy. The act of securing the information and the use of it by the members of a particular organization may be perfectly lawful in itself, but it is my belief that good morals and a sense of fair dealing require the giving of the information secured in this collective manner to the public generally, to the end that all persons engaged in commercial transactions involving the information in question will be on an even footing.—SECRETARY OF COMMERCE HERBERT HOOVER, *in a letter to the Department of Justice on the activities of trade associations.*

Cost-Plus Contract Form Being Drawn Up by Associated General Contractors.

Team-work between contractors, architects, engineers and owners is the object of the first draft of a new cost-plus contract which has been made by the Research Division of the Associated General Contractors under the direction of the Committee on Contracts. This type of contract is not advocated by the association to the exclusion of lump-sum agreements; but, for the benefit of contractors and owners who do not desire to operate under the latter type, a new form of cost-plus-a-fee agrement has been drawn up. A form of lump-sum contract is in preparation and will be issued shortly.

New Officers of American Engineering Standards Committee.

At the adjourned annual meeting of the American Engineering Standards Committee, held in New York, February 9, Albert W. Whitney, a representative of the National Safety Council, was elected chairman. The representative of the American Society of Mechanical Engineers on the executive committee is Eugene C. Peck. The gas group is represented by A. Cressay Morrison and the Department of the Interior by O. P. Hood.

DEVELOPMENT OF NEW DOUBLE-CURVED MULTIBLADE FAN

BY A. A. CRIQUI,
Buffalo Forge Company.

As is well-known in the use of mechanical ventilating units, the arrangement of fans belted to electric motors permits of the use of standard motors at higher speeds than that of the fan, which make the first cost of the unit attractive. There are several objections, however, to this arrangement, such as the annoyance of belt troubles, but the most objectionable feature is the great amount of floor space required.

For this reason direct-connected units have been given preference of late years,

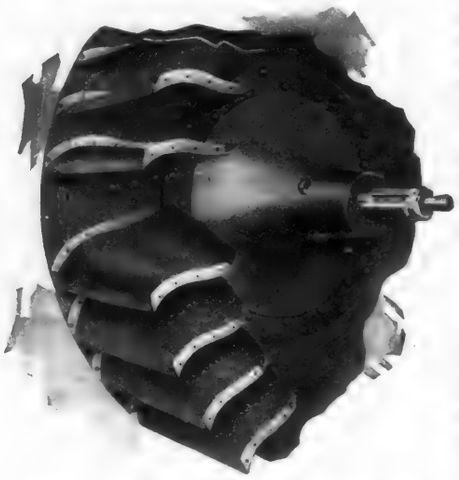


FIG 1. DOUBLE-CURVED WHEEL OF MULTIBLADE FAN.

although the first cost is considerably above that of the belted units, principally on account of the large-framed low-speed motors which are necessary to suit the low speeds of the present forward-curved multiblade fans.

A new type of multiblade fan has been brought out by the Buffalo Forge Co., Buffalo, N. Y., which operates at a higher speed for a given pressure than the old standard forward-curved blade type of multiblade fan and thus makes it possible to use smaller-framed motors on direct-connected units. This considerably reduces the first cost and at the same time reduces the space required.

In addition this new type of fan has two important advantages which may be illustrated by comparing the pressure and power characteristics of this and two other types of fans in common use.

RISE OF THE MULTIBLADE FAN.

Some years ago the multiblade type of fan, with forward-curved blades, practically displaced the older radial-blade type. This multiblade fan had the advantage of a far greater range of capacity for a given size and required less power to operate than the radial-blade type.

However, two exceedingly good features of the old radial blade fan were lost in the adoption of the forward-curved multiblade fan; namely, the continually rising pressure curve from free delivery to no delivery and the practically uniformly increasing power curve from no delivery to free delivery.

Fig. 2 illustrates the pressure curves of three types of fans, the old radial blade, the forward-curved multiblade, and the new double-curved multiblade type. In the case of the old radial-blade fan, the pressure has a continual rise from free delivery to no delivery within a comparatively limited capacity range. The forward-curved multiblade type rises in pressure from free delivery to a certain point and then drops slightly in pressure as no delivery is approached. The capacity range is far greater than that of the radial-blade type.

The new double-curved blade fan rises in pressure from free delivery to no delivery similar to the radial type but, according to test results, has a much greater capacity range.

EFFICIENCIES OF THE THREE TYPES.

Fig. 3 shows the comparative efficiency, as found from tests, of the three types of fans. The efficiencies of the forward-curved and double-curved types are far greater than that of the old radial-blade type. It is seen that according to these tests, the efficiency of the double-curved blade type of fan is better than that of the forward-curved type throughout the middle range of capacities. These capacities are those of moderate outlet velocity and suitable for the quiet operation required in public building work. The efficiency of the forward-curved type of fan is shown to be slightly better at the higher capacity ranges, such as would be satisfactory for factory units where quietness of operation is not essential.

Fig. 4 shows the power curves, as developed from tests, of the same three types of fans. The old-radial-blade type has a straight-line power curve rising gradually from no delivery to free delivery. The forward-curved multiblade type increases gradually in power from no delivery to a certain point and then rises sharply with any greater increase in capacity. The new double-curved blade type starts out with a gradually increasing power to a certain point and then, instead of rising abruptly, it actually drops in its rate of increase as free delivery is approached.

A FREQUENT CAUSE OF TROUBLE IN FAN SYSTEMS.

When a forward-curved blade type of fan is operated at more than its proper rating, the combination of a pressure curve that droops and a power curve that rises abruptly is often the cause of trouble in fan systems. At such times, the flat or drooping portion of the pressure curves makes the fan very sensitive to resistance variation. Consequently when the actual resistance in an installation exceeds that which was specified or estimated, the capacity drops back and instead of meeting this condition with an increase of pressure, as the radial blade or double-curved blade fan does, the forward-curved blade type drops in pressure and sends the capacity far below the desired amount before it reaches a point at which the fan pressure balances the resistance. On the other hand, when a lower resistance is encountered than that specified, the forward-curved blade type of fan will operate at a greater capacity than desired and, on account of its sharply rising power characteristic, will require more power than estimated.

In the case of the double-curved blade fan, tests indicate that when resistance is encountered which is greater than calculated, this new fan will, like the old radial-blade type, by reason of the constantly rising pressure, meet the demand for greater pressure at a capacity which is relatively much nearer to the desired capacity. Again, if the resistance is less than anticipated, the capacity has been found to increase with but a slight increase in power. This fan, in other words, is self-adjusting to variations from the estimated resistance.

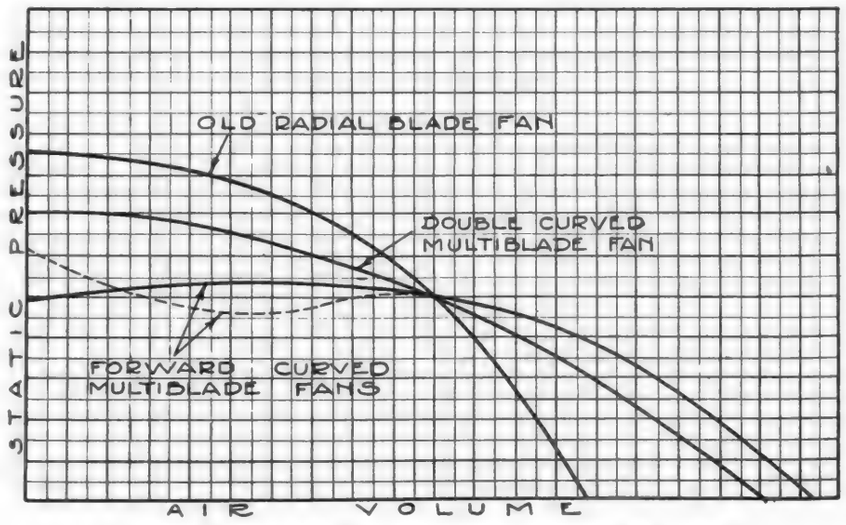


FIG. 2. PRESSURE CURVES OF THREE TYPES OF FANS.

EFFECT OF HOUSING DESIGN.

There are many designs of forward-curved blade fans and while all have the same general pressure and power characteristics, the drooping or flat portion of the pressure curve of each will vary with the housing design, and when a large housing is used, which will produce a greater conversion of velocity pressure into static and consequently result in a fan of higher static efficiency, the droop in the pressure curve will be more pronounced.

In short, it is shown by tests that the double-curved blade fan combines high-capacity and high-efficiency features of the forward-curved blade fan with the self-adjusting pressure characteristics and slowly-increasing power feature of the old radial-blade fan.

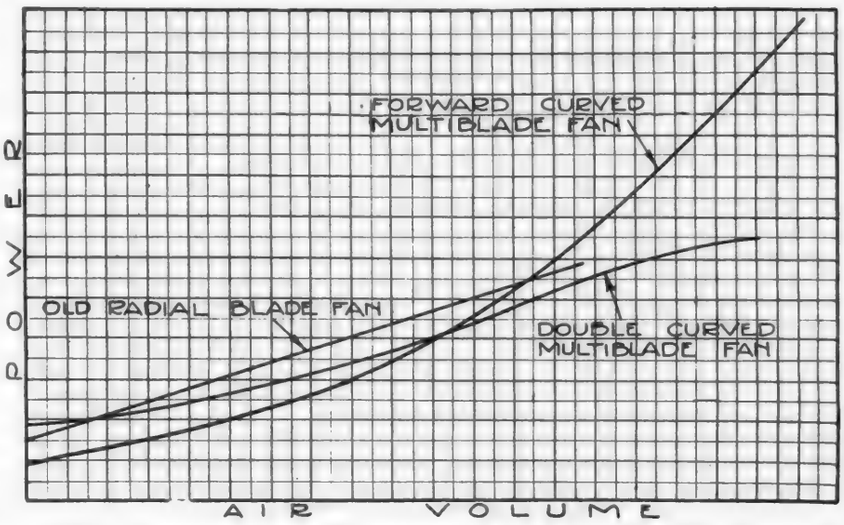


FIG. 4. POWER CURVES. AS DEVELOPED FROM TESTS OF SAME THREE TYPES OF FANS.

SPEED VARIATION EFFECTED BY CHANGING CURVATURE OF BLADE.

This new fan has blades which are curved forward at the heel to meet the incoming air at the proper angle and curved backward at the tip or periphery of the wheel to discharge the air at low velocity. Several designs have been developed, operating at different speeds for the same pressure. These different designs have speeds especially suited to different classes of work, the variation in speed being accomplished by changing the angle or curvature of the blade.

The speed of the double-curved type of blade is necessarily higher than that of the forward-curved blade on account of the difference in the blade design, but while the tip speed of the wheel is higher it will be seen, according to the tests, that, for the same static pressure, the actual air velocity leaving the tip of the wheel is not so high as that of the forward curved blade fan.

CHARACTERISTICS OF THE TWO TYPES, DUE TO VELOCITIES.

Figs. 5 and 6 show the parallelograms of velocities of the forward and double-curved types of fans. Let us assume the same peripheral velocities P and P′ and assume the same radial velocity through the wheels R and R′. The resultant velocity, V, of the air leaving the tip of the forward-curved blade will be far greater than the resultant velocity V′ of the air leaving the tip of the double-curved blade wheel.

Assuming also that the depth of blade is the same in each of the two designs, the static pressure developed within the wheels themselves, due to centrifugal force, will be the same. The conversion in the fan housing of the velocity pressure of the air leaving the wheel into static pressure will be greater in the case of the forward-curved blade fan because the velocity of the air leaving the wheel is greater, consequently the total static pressure produced by a fan of the forward-curved blade type will necessarily be greater than that of the double-curved blade type when operating at the same tip speed. Conversely for a given static pressure, the tip speed of a fan of the double-curved blade type will be greater than that of the forward-curved blade type, although the actual air velocity leaving the wheel will not be as great.

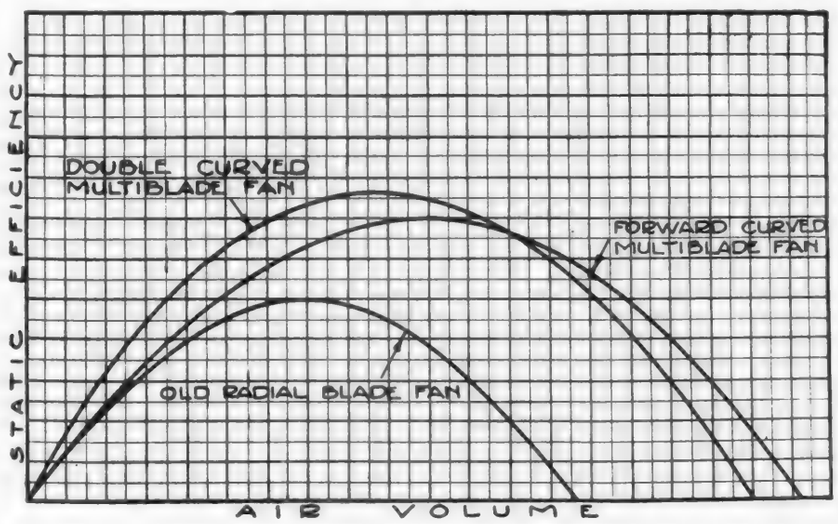


FIG. 3. COMPARATIVE EFFICIENCIES OF THREE TYPES OF FANS AS SHOWN BY TESTS.

As an illustration of this, let us assume that the forward curved blade type of fan in Fig. 5 is operating at a tip speed of 2832 ft. per minute and producing a total static pressure of 1 in. If the depth of blade is such that at this tip speed the static pressure developed within the blade itself, due to centrifugal force, is 0.5 in., then the static pressure converted by the housing from the velocity pressure of the air leaving the tip of the wheel will be 0.5 in.

Let us likewise assume that the blade of the double-curved type shown in Fig. 6, is operating at 2832 ft. per minute tip speed, the blade having the same depth and outer diameter as the blade in Fig. 5. Then the static pressure produced within the blade itself will be 0.5 in. or the same with the blade in Fig. 5. Assume also that the backward curvature of the tip of the blade is such that the velocity of the air leaving the blade is but sixtenths that of the blade in Fig. 3, then the static pressure converted from velocity pressure will be 36% of that converted by the blade in Fig. 5 and the total static produced by this fan at 2832 ft. per minute tip speed will be $0.5 + (0.36 \times 0.5) = 0.68$ in. Therefore to produce 1 in. static the blade in Fig. 6 will have to operate at a greater tip speed than 2832 ft. per minute.

At any tip speed in excess of 2832 ft. per minute the static pressure produced by centrifugal force, being more than 0.5 in. the remaining static pressure converted from the velocity head of the air leaving the blades must be more than 0.18 in. but less than 0.5 in.

In the case assumed these two components of the total static pressure would be 0.735 in. and 0.265 in. and the tip speed 3435 ft. per minute.

It is, therefore, evident that, under the conditions stated, although the tip speed of the blade is greater, the actual air velocity leaving the tip of the wheel is less in the case of the double-curved type of blade. Also the form of the blade is such that it gradually raises the air to the maximum velocity which it attains in leaving the tip of the wheel, the blade bending backward to discharge the air gently,

while the forward-curved blade abruptly precipitates the air forward from its tip at a higher velocity. As a matter of fact, the double-curved blade is actually deeper than the forward blade for the same wheel diameter and this fact further reduces the velocity of the air leaving the blade for any given pressure.

NOISES DUE TO HIGHER VELOCITIES.

The point may be raised that by reason of the higher speed of the wheel, the heel or cutting edge of the blade causes noise by cutting the air at a higher velocity. This was found not to be the case as the double-curved blade designs have a greater radial depth for a given diameter of wheel than the forward-curved types and, although the tip speed is higher for a given pressure, the heel speed is not higher, and, on account of this greater radial depth, the number of blades required in the wheel for maximum efficiency is proportionately reduced so that there are actually fewer cutting edges passing a given point per minute to produce a given pressure with the double-curved than with the forward-curved wheel.

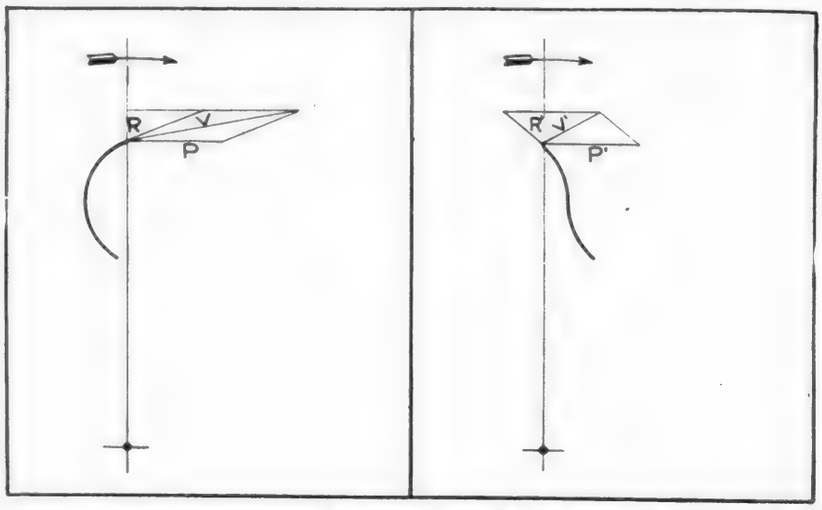
This fan has been given thorough tests on various types of installations for several years. There are hundreds of them in operation at tip speeds ranging far above 5000 ft. per minute which are reported to be entirely satisfactory.

Recently a U. S. Government inspector, running an acceptance test on a fan of the double-curved type of blade, was given instructions to take particular note of the noise as compared with that of the forward-curved type of fan which was used for the same duty. The tip speed of the double-curved type was 6300 ft. per minute, and that of the forward curved type was 4800. The inspector reported that the double-curved blade type of fan was more quiet than the other.

This report bears out the contentions made for this fan and indicates that higher tip speed with the double-curved type fan does not in itself produce a noise.

The fact is that there are many conditions that contribute to the noise of a fan system and it cannot generally be charged to any one circumstance. Installation conditions have much more to do with noise than is generally realized, but it is quite true that fans are often noisy. This is usually when the duct resistance has been overestimated so that the fan is overloaded with excessively high velocities through the wheels and the entire duct system.

The double-curved blade type of fan has proven to be a distinct addition to fan design by reason of its high capacity range and its high efficiency combined with pressure and horsepower characteristics which are as self-adjusting to existing conditions of resistance as it is possible to make them. At the same time it effects an economy in space requirements.



FIGS. 5-6. PARALLELOGRAMS OF VELOCITIES OF FORWARD AND DOUBLE-CURVED TYPES OF FANS.

Camp Roosevelt—Boy Builder.

Camp Roosevelt, the educational training camp for boys, which for the past three years has been located near Muskegon, Mich., will move this coming summer to LaPorte, Ind., where more adequate facilities are provided. The camp will be located on the site of the old Interlaken School. The innumerable log buildings, the tennis courts and the general beauty of the surroundings make this a real fairyland to the boy campers.

The boys live in regulation army tents, under the direction of army officers and trained athletic directors. The summer school, under the supervision of the Chicago Board of Education, is duly accredited and offers a variety of courses. A corps of trained experts from the Chicago High Schools has charge of the course in physical education.

The camp is not entirely a military camp, inasmuch as physical work and recreation occupy equal shares with the military in the daily program. This includes basketball, swimming, baseball, target practice, and all of the outdoor sports indulged in by the American boy. Weed-end hikes to nearby lakes are features. In the evening the entertainment includes movies, stunt nights by the companies, lectures by well-known business men, and campfires. This is the province of the welfare organizations.

Camp Roosevelt is a philanthropic institution. It was felt from the start that unless hundreds of boys, more especially the under-privileged lad, could derive benefits from its periods of training, the camp would not fill the need for which it was intended. Therefore, the boy who attends pays but a very nominal fee for bed and board. The financial backing for the establishment of the camp was secured, and is still maintained, by public spirited Chicago men, under the Chairmanship of Angus S. Hibbard.

The camp is divided into two periods of three weeks each. A boy may attend either one or both of these periods. If he desires to make summer school credits, however, it is necessary to remain for the entire season.

Major F. L. Beals, U. S. A., professor of military science and tactics and supervisor of physical education in the Chicago public schools, is the founder of the institution. The camp headquarters are located at the Chicago Board of Education, 460 South State St., Chicago.

SCENE AT CAMP ROOSEVELT, LA PORTE, IND.

TYPES OF WATER SERVICE HEATERS

V

Water service heaters as has been shown in previous articles in this series, are divided generally into two types, the instantaneous or water-tube type and the storage or steam-tube type. The storage heater was the first in the field, and prior to 1890 was the type of heater most generally used, and still retains many advantages, but the instantaneous heater is inherently more efficient and has a broader economic field. However, the selection of either type is entirely dependent upon the requirements of each installation.

Since in many plants, only a small amount of exhaust steam is available, and the rate at which it is exhausted from the engine or pump is not rapid enough to heat the necessary quantity of cold water to the desired higher temperatures, the use of a storage type of heater in which the steam passes through the tubes is advisable, so as to allow storage of this heat as rapidly as steam is exhausted.

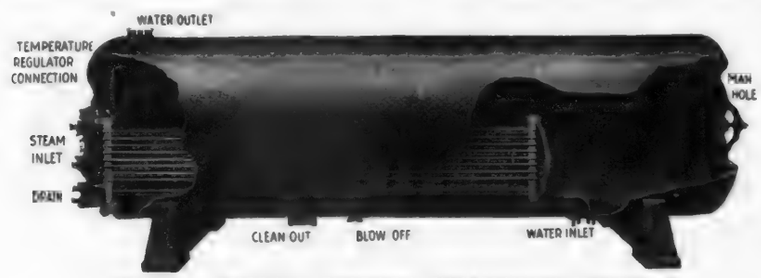


FIG. 1. RUSSELL STORAGE STEAM-TUBE HEATER.

Such storage continues during the longer period of minimum hot water requirements, until the water eventually becomes thoroughly heated throughout and instantly available for the relatively shorter maximum demand, the tank full of hot water then supplementing the small steady supply of exhaust steam. In this way the load is successfully carried with due consideration of economy.

With a heater of proper proportions, periods of heavy load can be handled without the use of any live steam and this is a distinct economy as, for example, in the case of a hotel where heat from the exhaust steam is stored in the heater during the night when very little hot water is required, so that by morning the tank is full of hot water ready for use.

In any building where hot water is required, it is apparent that the use of live steam as a heating medium would be an expensive method of operation, since exhaust steam after performing useful work in engines and pumps may be piped so as to enter the water service heater, and thus save heat otherwise lost. In dyehouses, laundries, apartment houses, and many other places where intermittent or sudden and heavy drafts of hot water are required, and where exhaust steam is limited in supply, the storage type of heater thus becomes more suitable to the conditions.

In this type of heater it had long been the custom to use U-tubes for the heating element, but The Griscom Russell Co., to whose products this article is devoted, realizing that a certain volume of steam when condensed occupies only about 1-1600 of its volume as steam, became convinced that the large area of drain tubes in the U-type element meant the use of extra material where not required. Checking this up by careful study and experimentation, they found that practically all heating took place from the upper or outgoing U-tubes, the lower row or return portion simply acting as drain pipes to return condensed steam. For that reason the design of the original Russell storage heater was changed to straight tubes of sufficient number and equal length to insure the required heating effect, as well as condensation of the steam by the time it reached the rear end of the tubes in the heating element.

It is, therefore, necessary to provide only a sufficient area of drain tube section to carry the condensation back to the steam head (Fig. 1).

FIG. 2. RUSSELL STORAGE HEATER WITH TUBE BUNDLE REMOVED.

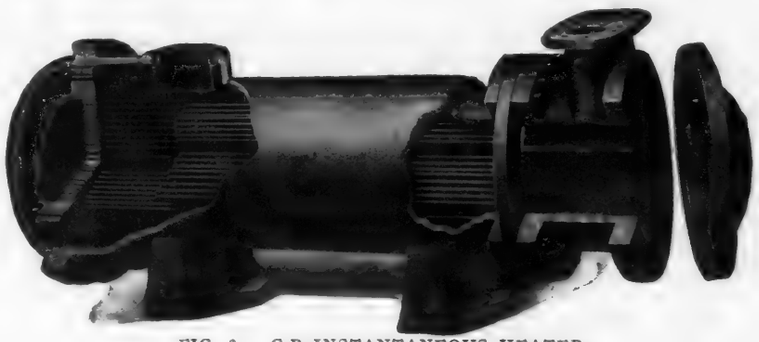


FIG. 3. G-R INSTANTANEOUS HEATER.

A floating head permits of expansion and contraction of the tubes without strain on the tube joints. The use of the straight tubes eliminates the necessity of the removal and scrapping of a large portion of the tube surface to replace an inner tube. The entire tube bundle is easily removable from shell (Fig. 2).

A water-inlet directing nozzle is also used to accelerate proper circulation and improve heating efficiency.

STRAIGHT-TUBE INSTANTANEOUS HEATERS.

About 1890 the Goubert Mfg. Co., of New York, placed on the market the pioneer instantaneous heater known as the Goubert heater.

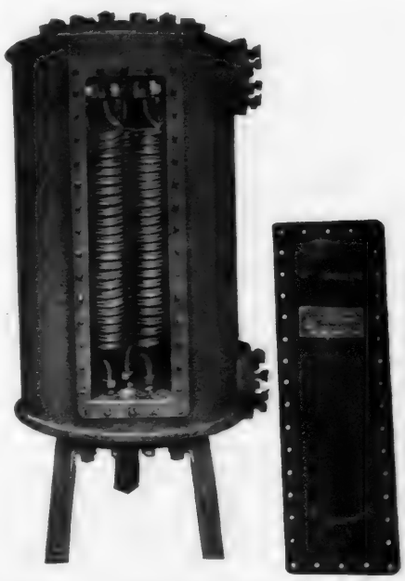


FIG. 4. REILLY MULTICOIL HEATER.

The Griscom-Russell Co., who succeeded the Goubert Mfg. Co., completely redesigned the Goubert heater, based on increasing knowledge of the laws of heat transfer, and in 1919 placed on the market the G-R instantaneous heater (Fig. 3). This heater is made with a cast-iron shell

and, as in the storage type, is also made with straight tubes of seamless drawn brass expanded into tube plates at each end, one of which is fixed and the other made floating, so as to permit expansion and contraction of the tubes without strain on expanded joints. As designed for a working pressure of 250 lbs. per square inch, it is a suitable closed feed-water heater for boilers, and may also be used as a hot water converter in large buildings, or groups of buildings, heated by forced hot water circulation.

FIG. 5 WATER TUBE FOR MULTICOIL HEATER.

FIG. 6. REILLY PATENTED SCREWED UNION JOINT FOR MULTICOIL HEATER.

In this type of water-tube heater, which is the inverse of the steam storage heater, the water passes through the tubes and is heated by exhaust or live steam in the shell enclosure, and only a few seconds are required for the passage of a drop of water through either the two, four, six or eight passes in which the tube bundles of the heater are arranged. During this time, however, the water is heated to the desired temperatures. Another desirable feature is that the heater can be operated far in excess of rated capacity for considerable periods with only a slight reduction in the final temperature of the water. Such results cannot be secured with a steam-tube storage type heater in which a large body of water must be heated to the outlet temperature before hot water can be drawn off and which cannot be operated efficiently at overload for any length of time.

Considering the adaptability of the instantaneous heater, it is quite flexible and has many uses, as for instance, general hot water service, the boosting of water temperature in a storage heater where the exhaust steam available is insufficient during certain periods, and where the necessary rise in temperature must be produced at such times by the use of live steam. Such rise in temperature is best accomplished by placing the required additional heating surface outside of the storage heater shell, that is, inside of another heater of the instantaneous type, and to which hot water from the storage heater is piped so as to flow through this heater before being used in the system. This method is the most logical, since under the conditions cited, it is imperative that the action of the heater be rapid, and the instantaneous type of heater is the most ideal for this service. Furthermore, as live steam has to be used, it is important that the amount be limited, and if thermostatic control is placed on the outlet from the instantaneous heater, instead of being used on the storage heater, it insures that live steam is turned on only during periods when it is necessary to boost the temperature by the use of the instantaneous heater.

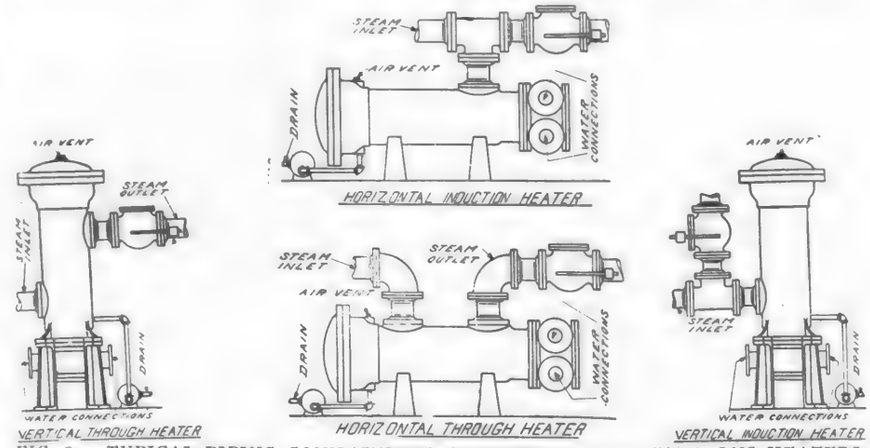
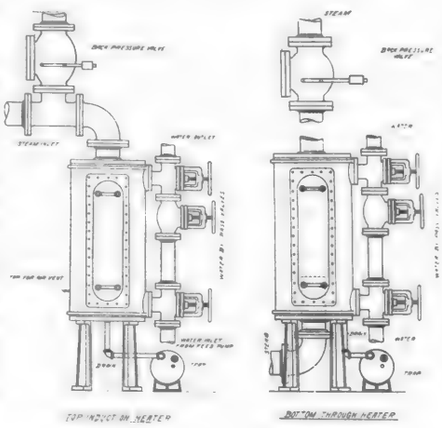


FIG. 8. TYPICAL PIPING CONNECTIONS FOR REILLY INSTANTANEOUS HEATERS.

THE MULTICOIL TYPE OF INSTANTANEOUS WATER-TUBE HEATER.

Another type of instantaneous water-tube heater manufactured by The Griscom-Russell Company, mainly for heating of feed water, is the coil-type Reilly Heater shown in Fig. 4. This type of heater is particularly compact, occupies very little head room and gives a large heating capacity per square foot of space occupied, also all expansion strains are avoided since each coil is a spring. Helical construction of coils (Fig. 5) imparts a whirling motion to the water, and centrifugal force throws the water particles from the center of the tubes to the outside, where they are in turn displaced and returned to the center. Also the tubing, being crimped throughout, further assists in breaking up the body of water flowing.



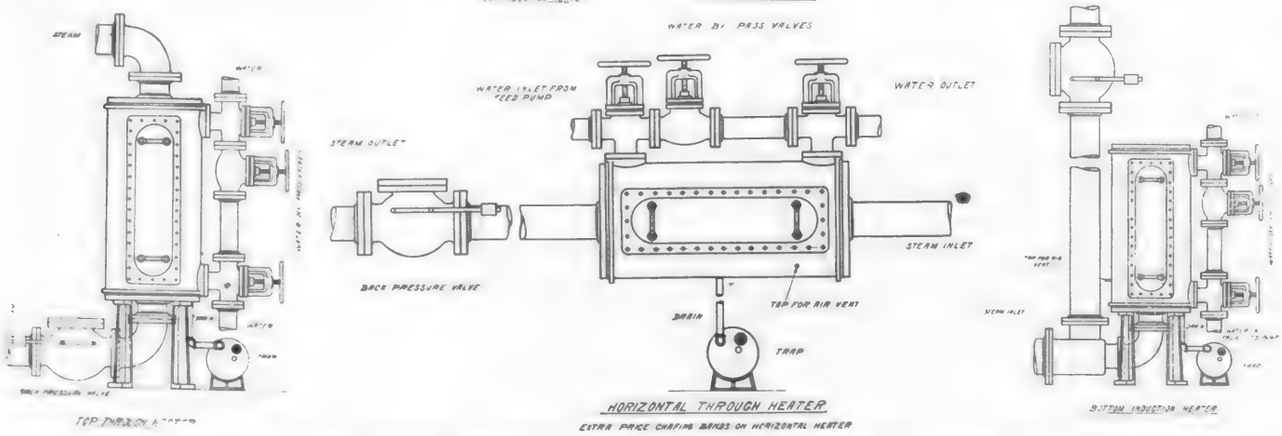


FIG. 7. TYPICAL PIPING CONNECTIONS FOR GOUBERT INSTANTANEOUS HEATERS.

The Reilly patented screwed union coil joints (Fig. 6) by which coil ends are connected to manifolds, eliminate any possibility of water leaks, and also allow the easy removal of the coils for inspection or replacement. Being interchangeable, it is not necessary, if all coils are removed, to replace each coil on exactly the same spuds as previously.

One of the distinct features of this heater is the door in the shell. This is made light weight so as to be easily removed by one man, and thus facilitate inspection of the heating surface while under water pressure, as for the purpose of detecting leaks, etc.

PIPING CONNECTIONS FOR INSTANTANEOUS HEATERS.

Instantaneous heaters may be installed, either by the thoroughfare or induction method, as shown grouped in Figs. 7-8, also in horizontal or vertical position, and with top or bottom steam supply connection. In the thoroughfare method all of the exhaust steam passes through the heater, but in the induction method, only one steam connection is required, and a back-pressure valve on the steam line induces into the heater sufficient steam for the heating requirements.

In by-passing Reilly heaters, either single or two pass, use is made in each case of two three-way valves, two elbows and a distance piece, and it is essential that every feed water be provided with such connections, so as to provide a by-pass for the feed water to the boilers, whenever it is necessary to cut out the heater for inspection or repairs.

New Apparatus and Appliances

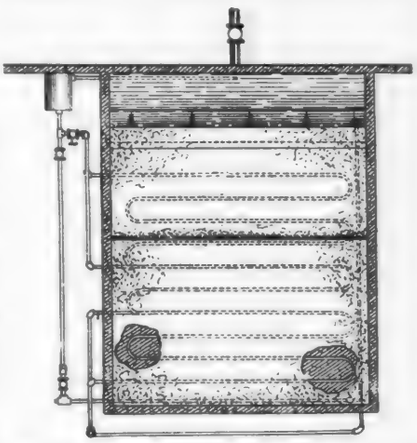
A New Cooling and Air Washing Device.

Some novel ideas have been applied in the development of a new apparatus which is being marketed by Midgley Bros., 22 Richards Street, Salt Lake City, Utah, under the name of the Midgley-Gilbert cooling and air washing device. The inventors are E. A. Midgley and J. E. Gilbert of that city.

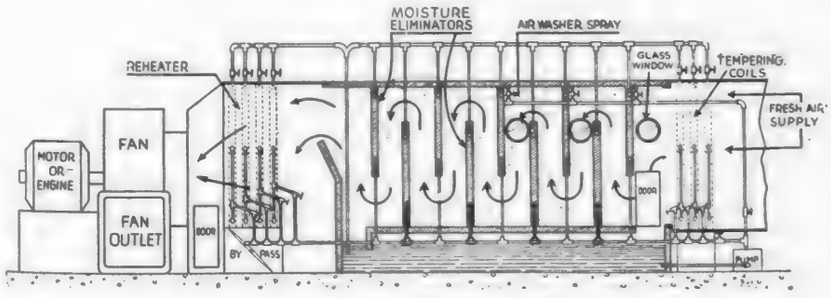
As will be seen from the accompanying illustrations, this apparatus is designed to be constructed preferably of concrete so that when it is being used for cooling purposes, it will remain cool for some time and vice versa. It has a number of baffle plates or partitions located in the path of the air flow. These baffles are water-cooled by means of pipe coils embedded in them through which cold water is pumped. In addition there are water sprays at the top of three of the baffles. These sprays are in the form of perforated pipes which spray water on the sides of the baffles. It then falls down through the passing air to the receptacle at the bottom of the apparatus. Ice, water, or other cooling substance may be placed in this receptacle. Circulation of the water is secured through a small pump which is so valved that the water spray may be cut out if desired and only the pipe coils in the baffles used.

The air, after passing through the washers impinges against the remaining baffles which serve as moisture eliminators and may then be reheated or not as desired. When constructed of other matarial than concrete, the cooling coils are installed on the outside of the baffles.

It is stated that with the use of this apparatus, it is possible to heat and ventilate a building in the winter and cool and ventilate it in summer with the same apparatus. One of the advantages of its design is that, when made of concrete, it can be manufactured and installed during the construction of the building and can also be designed to fit into the construction of old buildings. Special emphasis is placed on the elimination of rust through the use of concrete, also the elimination of spray nozzles, reducing to that extent the cost of operation and upkeep. A drain pipe is provided to empty the receptacle at the bottom of the apparatus when desired.



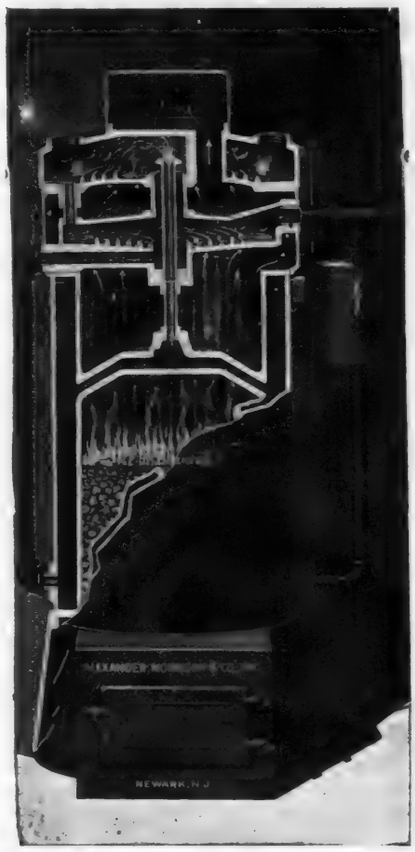
ARRANGEMENT OF COOLING COILS IN MIDGLEY-GILBERT AIR WASHER.



DESIGN OF MIDGLEY—GILBERT COOLING AND AIR WASHING DEVICE.

The Percoplate Boiler.

A heating boiler of unique design and operation has been perfected by two young men of Newark, N. J., Earl S. and Carl Z. Alexander, and is now being marketed under the name of the Percoplate boiler. The name is suggested by the operation of the boiler. It is so designed that less than a single gallon of water is heated at one time to generate steam, as against 30 to 50 gal. in the ordinary type of house heater. By this means, steam is produced within three or four minutes after the fire is lighted and from then on steam continues to generate in greater and greater volume by a principle as simple as that of the coffee percolator.



CONSTRUCTION OF PERCOPLATE BOILER.

Immediately above the fire, which may be of any fuel, is located a cast-iron spider (shown in detail in Fig. 2) containing less than 1 gal. of water. This spider is fed with water from the water jacket through its cast-iron legs, six in number. The water supply, instead of being contained in a boiler immediately above the fire is contained in an equalizing water column at the right side of the boiler and feeds from this water column into the water jacket and then into the spider.

Before starting the fire the equalizing water column is filled with water to a point about midway of the gauge glass. As this is done the water jacket, the spider and the geyser tube (leading from the spider to the steam chambers above) will fill up to the same level. When the fire is lighted, the heated gases given off by the burning fuel pass up around and between the legs of the spider through the open heating space, striking upon the bottom of the lower steam chamber. Passing around the lower steam chamber, the hot gases strike the upper steam chamber and pass upward through three flues, only one of which is shown, and then on out through the smoke pipe.

FIREBOX CASTING CONTAINING WATER JACKET, WITH CAST-IRON SPIDER IN CENTER.

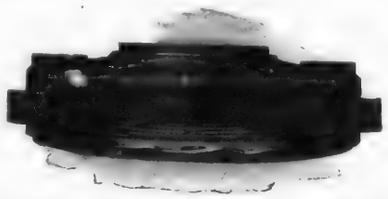
The heat on the legs and body of the spider warms the water, it expands rapidly and in three or four minutes is forced up through the geyser tube into the steam chamber at the top. As soon as the water, already raised to the steaming point, hits the hot plates of this steam chamber and is scattered over them, steam is immediately generated and passes through the outlet into the steam mains and the radiating system.

Any water which is not vaporized in the upper steam chamber drains to the outer edge and through the three nipples (one of which is shown at the left) on to the surface of the lower steam chamber where the process of steam generation continues, the steam from this chamber being carried off into the steam main and radiating system through the outlet. Any water not vaporized in this section drains toward the center, down through the equalizing pipe, shown at the left, and back into the general circulation. The returns from the radiating system are connected at either one of the return connections shown.

The water jacket is also connected directly with the upper steam chamber by six nipples leading from the openings, shown in detail in Fig. 2, passing directly by the lower steam chamber to the upper steam chamber. As the water in the water jacket becomes heated, these nipples carry highly-saturated steam into the upper steam chamber and act as auxiliaries to the main geyser tube in furnishing additional steam to the system.

In construction the Percoplate boiler has a cylindrical water-jacketed fire-pot section and two superimposed steam-and-water chambers, all of cast-iron and interconnected by short nipples. The whole is mounted on a conical base, the inside of which forms the ash-pit.

In a test of this boiler, made at Stevens Institute recently by two consulting engineers, Robert M. Anderson and Major J. Day Flack, the following data were obtained:



UPPER STEAM CHAMBER SHOWING WATERWAYS AND FLUE PASSAGES.

Steam pressure by gauge, pounds..	1.
Temperature steam, upper steam chamber, deg. F.	215.5
Temperature steam, lower steam chamber	213.3
Temperature feed water	76.
Temperature water in boiler at base	212.9
Temperature furnace below lower chamber	673.
Temperature furnace between upper and lower chambers	467.
Temperature exit gases (8" from boiler)	388.
Temperature boiler room	85.
Weight of coal used, pounds....	100.
Weight of coal per hour pounds..	12.5
Weight of coal per square foot of grate per hour	8.3
Weight of water from condenser (total evaporation)	870.
Weight of evaporation per hour, pounds	108.7
Weight of evaporation per pound of coal	8.7
Equivalent evaporation from and at 212° per pound of coal	9.93
Calorific value of one pound of dry coal, B. T. U.	12,696

Efficiency of boiler, furnace and grate

$$\frac{9.93 \times 970.4}{12696} = \frac{9636.072}{12696} = 75.89\%$$

LOWER STEAM CHAMBER SHOWING WATERWAYS.

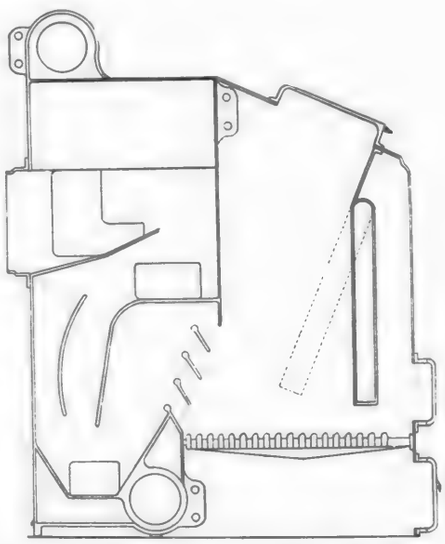
The total heating surface was shown to be approximately 18 sq. ft. of which 80% is exposed to the direct radiation of the fire. This is about 20% more than usual The proportion of heating surface to grate surface was 12 to 1.

The steadiness of the water level in the gauge glass was marked showing no priming effect.

"The rapidity with which this boiler can make steam" concludes the report, "is very marked. The time from the lighting of the fire to 1 lb. pressure by the gauge was 4 minutes, and to 9 lbs. pressure was 7 minutes. The temperature of the water in the boiler at the start was 73° F. at the bottom. At the end of 7 minutes with 9 lbs. pressure of steam by the gauge the temperature of the water in the boiler at its base had only reached 80° F., which shows that steam is generated practically from the time that the fire is lighted, and without the necessity of heating the entire body of water to the temperature of the steam."

Wayne Cross-Draft Smokeless Boiler.

A house heater of the smokeless type, with a cross draft and with a magazine feature so arranged that it can be adjusted to burn any kind of coal, has been brought out by the Wayne Heater Corporation, Richmond, Ind., under the name of the Wayne cross-draft smokeless boiler. The adjustment of the magazine is made by a movable magazine front which serves to reduce the size of the opening into the fire bed. The cross-draft feature is designed to give the boiler all the advantages of the down-draft types in that all gas, soot and smoke are drawn down through the fire. Other features



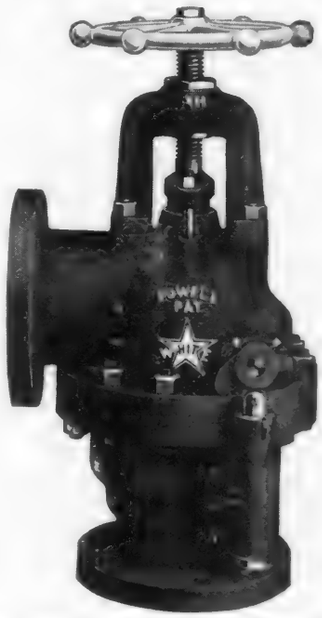
CONSTRUCTION OF WAYNE CROSS-DRAFT SMOKELESS BOILER.

are the boiler's 44-in. water line which is the same in all sizes and its 3-ft. stoking bars, which are long enough for the largest Wayne boiler made. The grates are designed to always remain in position, being automatically locked when the shaker bar is released.

The magazine is large enough to hold sufficient fuel for a 12 to 24-hour firing period. As the coal settles down in the magazine it is brought gradually to the ignition point, so that the gases are released gradually and, it is stated, are consumed continuously. The boiler is made in sixteen sizes, with capacities ranging from 1500 sq. ft. steam or 2400 sq. ft. water radiation to 8000 sq. ft, steam or 12,800 sq. ft. water radiation. The following dimensions are the same on all sizes: width 49 in., water-line 44 in and total height 62 in.

New Boiler-Check Valve.

A new boiler-check valve that is especially designed to fulfill the requirements of the revised boiler laws has been developed by the Wm. Powell Co., Cincinnati, O., and is being marketed under the name of the new Powell "White Star" triple-acting non-return regulating boiler-check valve. It has a steam governing-cylinder and is described as non-chattering. In steam plants using more than one boiler this valve is of special value in preventing danger to workmen engaged about the power plant as it gives full protection to the entire equipment, including boilers,



NEW POWELL "WHITE STAR" BOILER-CHECK VALVE.

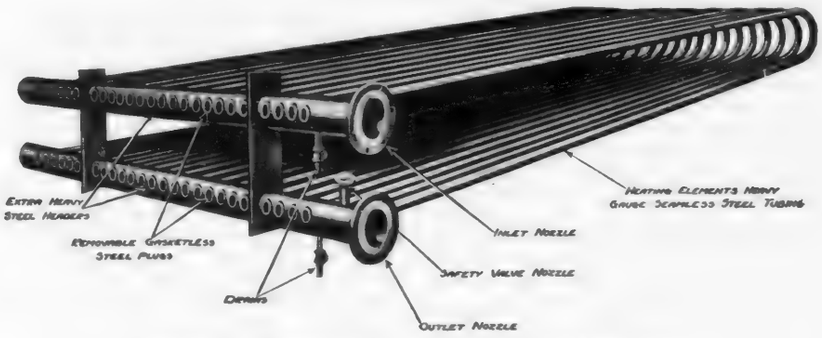
header and engine. In the event, for instance, of the blowing out of a tube, the valve closes, isolating the boiler involved. This makes it possible to continue operation of the plant without a shutdown. The valve is also designed to close instantly in case of accident by an unusual or sudden movement of steam in either direction. Finally it operates to close by gravity when the boilers are cooled down, and will not re-open until pressures are created and equalized in the boilers. It is made with a cast-iron body and yoke for standard steam pressures up to 250 lbs., and of cast-steel for superheated steam. The stem is of steel, working outside in the yoke where steam cannot reach the threads. The disc and seats are of "Powellium" nickel bronze, or, when specified, of monel metal.

New Books.

COAL MANUAL, by F. R. Wadleigh, is the title of a new book published by the National Coal Mining News, Cincinnati, O., which is intended for the general public, as well as for the technical men and operating engineers. The information given is of a practical sort, covering such subjects as kinds and commercial grades of coal, information in regard to the location of coal from various fields and the essential differences in the character of coal from various fields and seams, the preparation of coal, coke and gas manufacture, the use of coal in locomotives and stationary boilers, storage and prevention of spontaneous combustion, specifications and their use, analyses and effects of various impurities, together with a brief bibliography on the subject of coal. The manual will serve as an excellent guide for coal buyers and executives generally who make coal contracts. Size 4½ x 6 in. Pp. 184. Price, cloth, $2.50; leather, $3.50. May be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

Trade Literature.

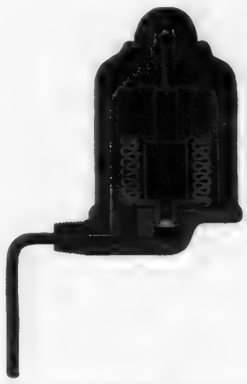
WHITLOCK ALL STEEL SUPERHEATERS, a recent addition to the line of the Whitlock Coil Pipe Co., Hartford, Conn., are brought to the attention of the trade in a new bulletin (No. 30). This superheater is of the bare tube all-steel type, the headers being constructed of extra-heavy open-hearth steel, with the inlet and outlet nozzles Van Stoned and provided with extra-heavy steel flanges. The tube element consists of heavy-gauge seamless drawn steel tubing, expanded into the



DESIGN OF WHITLOCK ALL-STEEL SUPERHEATER.

headers. It will be noted that the heating elements are so arranged that any one element can be removed or replaced without interference with any other tube. The openings in the headers opposite the tube terminals are closed by gasketless removable steel caps. The bulletin discusses the operating features of the superheater, showing how high final temperatures are easily secured, with low pressure drop through the superheater and are obtained at high boiler ratings. The discussion then takes up the effect on the boiler, engines, pumps, turbines, pipe lines, condensers, of this type of superheater, as well as the effect on coal consumption, concluding with some interesting performance curves. Size 5½ x 8½ in. Pp. 8.

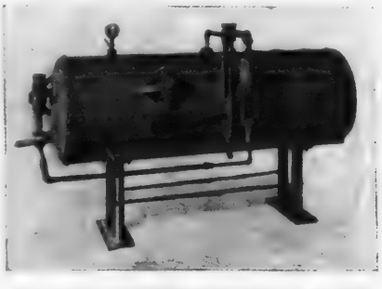
SYLPHON VENT VALVES, Sylphon regitherms, Sylphon temperature regulators and Sylphon packless and standard radiator valves are shown and described in separate circulars published by the Fulton Co., Knoxville, Tenn., and especially compiled for handy reference. Each circular contains the necessary data in addition to concise descriptive matter and illustrations which show at a glance the important construction features of the various devices. In the packless and leakless type of Sylphon radiator valve the stem is surrounded by the two-ply Sylphon bellows, and the point is made that the stem and rotating parts being inside this metal bellows are not exposed to the steam or wash of the system, so that they cannot corrode



SYLPHON RADIATOR AIR VALVE.

or become clogged. The measurements of the leakless type, it is further noted, are standard, so that even on old work they may be used without changing the piping. The Sylphon radiator air valve, as described in last month's issue, is designed with enlarged venting ports so that the air may be expelled quickly at one place.

LADD RECEIVER-PUMP, return trap type, for use in pressure heating, as well as for vacuum and vapor heating systems, is featured in a new circular received from the G. U. Ladd Co., 104 Harding St., Worcester, Mass. These pumps, it is stated, will operate with full economy with steam as low as 1 lb. gauge pressure for both vacuum and boiler-feed purposes, as well as with high-pressure steam. They

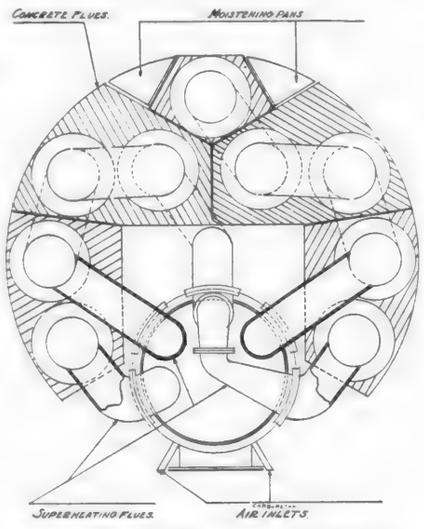


LADD RECEIVER PUMP, RETURN TRAP TYPE.

are adapted for systems of 5000 sq. ft. of radiation or more. Among the advantages mentioned for this pump is that it combines in a single unit the two functions of producing vacuum for the return of condensate and a pressure for pumping the condensation to the boilers. The functional operations of the pump are, first, that of a receiver pump with its stationary receiver or tank with any desired number of inlets for receiving condensation and with the operating parts attached directly to or detached from the receiver; second, that of a condenser-return trap, but free from such disadvantages as requiring the addition of cold spray water to condense the steam. In addition to acting as a return trap, this pump, it is added, will handle condensation of different and varying pressures above atmosphere and at the same time will maintain a vacuum for taking the condensate from the vacuum units.

The complete cycle of operation is as follows: Condensation flows into the receiver from one or more inlets. The pilot valve is so arranged that pressure operated by it is applied for closing and keeping closed the steam-operating valve. This action also controls the air-relief valve and water-spray valve, in case either or both are used, with the float at a predetermined position. Increased elevation of the water in the tank will elevate the float. When the predetermined level is reached, the engaging arm of the float is designed to change the pilot valve, thus removing the pressure through the pilot and opening the port of the pilot so that all pressure is removed from the piston or diaphragm. The lever and weight then open the steam-operating valve, allowing steam to enter on top of the water in the tank and closing the air relief and spray valves. The water is then lowered by discharge from the tank until the original predetermined position of the float is reached, when the float arm again engages the pilot valve and pressure is again delivered to the piston or diaphragm and steam pressure is cut off from the tank by the closing of the operating valves.

THERMOGEN STORAGE HEATER is a curious development of a warm-air furnace described in recent circular matter published by the Storage Heater & Furnace Co., Highlands, N. J. The designer of this heater has sought to profit by the

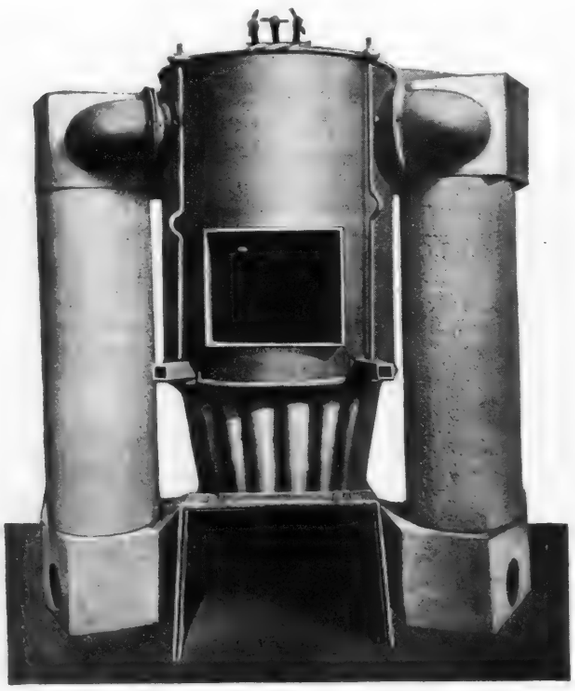


PLAN OF THERMOGEN STORAGE HEATER, SHOWING FLUE WAYS.

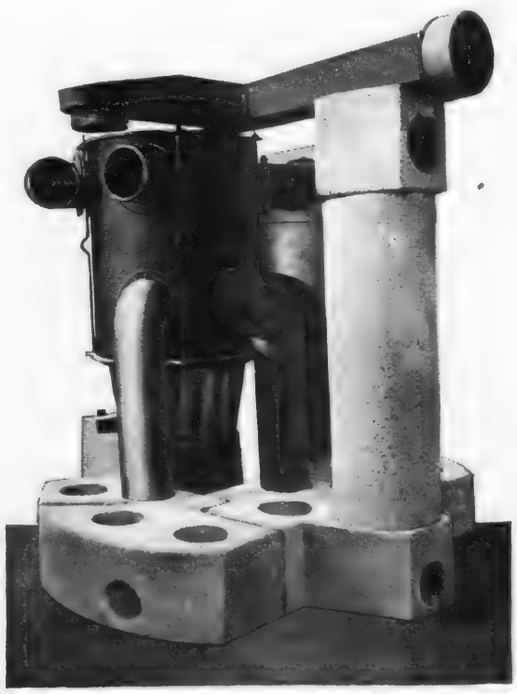
experience gained from observing the way heavily constructed buildings retain their heat. In this heater the furnace proper is surrounded by massive concrete castings with openings to serve as flues for the combustion gases. By this means the heater contains an extraordinary amount of indirect heating surface, amounting to no less than 252 sq. ft. It is claimed that with this arrangement the stored heat will keep the ordinary house warm from 18 to 24 hours after the fire is out. The design also provides for the return of the cooled air through two ducts in back of the storage and remote from the heat coming into contact with humidifying or vapor pans which are located at the bottom of the air ducts. All joints, it is stated, are permanently gas and dust-proof. The heater is equipped with a three-way damper giving full control for direct, storage or banked fire. As might be expected, the weight of the Thermogen storage heater is 3800 lbs., while its diameter is considerably greater than that of the ordinary warm-air furnace.

MAGNITUDE OF THE POWER PLANT'S CHIMNEY LOSS is the title of a new bulletin (No. 220) issued by the Uehling Instrument Co., Paterson, N. J., which contains a compilation of matter on this subject some of which is reproduced from technical papers of the Bureau of Mines and from engineering works on this subject, all pointing to the advantages to be gained through the use of recording CO_2 meters and recording pyrometers. Among the tables is Gebhardt's table of "Heat Carried Away by the Chimney Gases per Pound of Combustible" with different percentages of CO_2 and varying chimney gas temperatures. A supplementary bulletin (No. 221) takes up "Relation Between CO_2 and Money Wasted Up the Chimney" which contains, among other things, a chart showing the saving in dollars per year per 100 boiler horse-power by increasing the percent CO_2 in the flue gases. Size 6 x 9 in. Pp. 8 and 12, respectively.

A TYPE FOR EVERY PURPOSE EVERYWHERE is the title of a circular devoted to the Incinerite garbage burner, manufactured by E. C. Stearns & Co., Syra-



FRONT VIEW OF THERMOGEN STORAGE HEATER, WITH CASING REMOVED.



BACK VIEW OF THERMOGEN STORAGE HEATER, SHOWING THREE-WAY DAMPER FLUE.

cuse, N. Y. While Incinerites are made in both portable and wall types, it is stated that the wall type usually is specified by architects. They are built in two models, one with removable ash pan, and

THE INCINERITE GARBAGE BURNER.

the other with a special ash-dumping attachment. In the latter type there is a special hopper with slide which, when pulled, dumps the residue into the bottom of the flue in the basement.

HERBERT MAGAZINE WATER-TUBE SMOKELESS BOILERS, as well as the Herbert down-draft detachable firebox tubular boilers, are featured in recent catalogues issued by the Herbert Boiler Co., Chicago, Ill. In the magazine water-tube smokeless type, special attention is called to the fact that it has no flues to clean, to its ability to burn slack coal successfully and to carry fire ten to twelve hours on one firing; also its adaptation for down draft or direct draft to suit weather conditions, its low water-line, its wrought-iron tubes, its long fire travel, the small space it occupies and the wide variety of sizes in which it is built, running from 1000 to 25,000 sq. ft. radiation capacity. The Herbert detachable firebox boiler is described as especially durable. It is designed to combine the good features of the horizontal tubular and the firebox types. Through the additional surface contained in the firebox the capacity of this boiler, it is stated, is increased at least 25%. Its economy is accounted for by the fact that the flames pass over the entire shell and back head of the boiler before entering the flues, then back to the front and over the shell to the chimney. Special attention is called in the catalogue to the circulation between the back end of the boiler and the firebox which is an important factor in producing quick steam capacity. All of the parts, it is added, are accessible for cleaning, while a new firebox may be substituted without moving the tubular boiler or destroying the setting. It is shipped in two parts, a feature which makes it possible to pass the boiler through a comparatively small opening. A full line of both types is listed. Size 9 x 6 in. each. Pp. 24 and 32, respectively.

SAVE COAL AND MONEY BY THE USE OF THE KING KOAL KARBURETOR is the advice given by the manufacture of this device, Frederick Sabin & Co., Philadelphia, Pa., in a catalogue received from that firm. King Koal Karburetor is intended to be applied to any type of furnace, boiler, tank heater, or coal range. In the case of house heaters it is applied to the feed door and acts as a carburetor to provide the required quantity of hot oxygen over the burning coal to fire the carbon monozide gas which might otherwise pass up the chimney unconsumed. Summarized data and results of several tests are presented

KING KOAL KARBURETOR INSTALLED IN DOOR OF BOILER.

confirming the company's claims. These are accompanied by directions for installing and operating the device, the catalogue concluding with some 30 pages of testimonials and references. Size 4 x 8¼ in. Pp. 66.

SCIENCE AND PRACTICE OF INTEGRAL WATERPROOFING, as applied to basements, reservoirs, tunnels and masonry structures of all kinds, are discussed in an interesting technical booklet published by the Truscon Laboratories, Detroit, Mich. The manual states the waterproofing problem and how to solve it in a compact and convenient form. After discussing why concrete requires waterproofing, the manual gives specifications for waterproofing mass concrete, and general masonry by the cement plaster coat method and by the use of waterproofing cement stucco. A special chapter is devoted to the practical application of the waterproofed cement plaster coat. Size 4 x 9 in. Pp. 34.

Instruction Course on Fuel and Combustion Engineering.

The interesting announcement is made that Joseph W. Hays, who is well known as a writer on combustion, has prepared a course on fuel and combustion engineering. Associated with Mr. Hays in the development of the course are Professor S. W. Parr, of the University of Illinois; Fred R. Low, editor of *Power;* David Moffat Myers, formerly of the U. S. Fuel Administration; Arthur L. Rice, editor of *Power Plant Engineering;* W. L. Abbott of the Commonwealth-Edison Company of Chicago; Joseph Harrington, formerly of the Fuel Administration; and I. E. Moultrop, of the Edison Electric Illuminating Company of Boston. The course is offered through the Hays School of Combustion, 1412 South Michigan Avenue, Chicago.

The course, it is stated, is suitable for factory plant employees, as well as representatives of power plant manufacturers. In some cases the firms themselves find it to their interest to defray the expense of the course for groups of their men.

Deaths.

ALBERT C. ASHTON, treasurer of the Ashton Valve Co., Cambridge, Mass., died January 31, at St. Petersburg, Fla., where he had gone for his health. He was 54 years old. Mr. Ashton was a son of the late Henry C. Ashton, founder of the Ashton Valve Company. He was a member of the American Society of Mechanical Engineers.

JOHN F. KENNEDY, an engineer and estimator in the office of William H. McKiever, heating and ventilating engineer and contractor, New York, died February 14, of pneumonia. Mr. Kennedy specialized in sheet-metal construction for ventilation, and had charge of this work at the Rhode Island State Capitol, the New York Public Library building, the National Park Bank in New York, and the United States Housing Project at Bridgeport, Conn. He was a member of the American Society of Heating and Ventilating Engineers.

Hoffman Specialty Company Host to Philadelphia Jobbers.

Over 250 heating and plumbing supply men of Philadelphia, together with representations from New York and other cities, were guests of the Hoffman Specialty Company, manufacturer of the Hoffman line of heating specialties, at a dinner at the Manufacturers' Club, in Philadelphia, February 24. The affair, in many respects, was considered one of the most unique of its kind in the history of the trade.

George D. Hoffman, founder and president of the Hoffman Specialty Company, was on hand to receive the guests, although the direct management of the dinner was in the hands of Charles V. Haynes, the company's new vice-president and general manager. The New York guests were accompanied to Philadelphia by James K. Peacock, manager of the company's New York office.

The club rooms were already filling with guests when the New York delegation arrived and by the time of the dinner hour the crowded club quarters had all the appearance of a jobbers' convention hall. After the guests had partaken of a dinner which measured well up to the best traditions of the club, President Hoffman extended a formal welcome to those present and expressed his gratification in having as his guests so many representative men in the supply trade. He then introduced T. J. Miller, a statistician of the Curtis Publishing Company, of Philadelphia.

Mr. Miller spoke at length on business conditions and prospects throughout the country. He said the old methods of selling in which distribution pure and simple was the keynote were rapidly giving way to methods which required the jobbers to become merchandising managers. One of the troubles at the time of the business slump in the fall of 1920, he said, was the fact that everyone was overstocked and while the advertised lines continued to leave the shelves the merchants were not willing to order new stocks until the less popular lines were also sold. At present stocks are skeletons and the jobbers' problem is to buy lines that already have public acceptance. Such lines, he argued, are those which are nationally advertised, provided they have the requisite quality. The number of stocks and brands, he said, must be reduced to a minimum so as to cut out what he termed the "cobweb" lines.

Turning to the problems of salesmanship, Mr. Miller said the trouble with salesmen to-day is that they do not know the problems of retailing in detail. They do not know the past records of the retailers with whom they deal. They must not only know these things but must study the "potential" of these retailers for next year and the year after. The secret of selling, he said, depends first upon the selection of good dealers; second, upon service, including adjustment and repairs; and, third, upon owning a lot of favorable public opinion, or good advertising.

Mr. Miller also paid his respects to dealers who make a practice of what he termed "spineless selling," or the non-maintenance of prices.

As Mr. Miller concluded the prolonged applause showed how well his message had been received and how accurately he had analyzed the business outlook, especially in the supply trade. Both Mr. Hoffman and Mr. Haynes were warmly congratulated on the success of the occasion which, it was generally agreed, will have important results in promoting better business, as well as a better feeling, among the supply dealers of Philadelphia.

HOFFMAN SPECIALTY COMPANY'S DINNER IN PHILADELPHIA, FEBRUARY 24.

"All the Heating Comforts of Home."

Warmth and comfort are the keynotes of a life-like window display at the New York branch of the American Radiator Company. So natural are the figures and settings that the display is the magnet for an interested crowd of passers-by throughout the day. The Ideal Arcola heater which is shown near the fireplace seems to fit in the picture quite naturally. Its features and advantages are brought to the attention of the passers-by by means of changing slides.

AUTOVENT FAN & BLOWER CO., Chicago, Ill., manufacturer of the Autovent line of propeller fans and louvres and the Uniblade line of pressure and volume blowers, has opened a direct factory branch office in Cleveland, O., at 508 Fidelity Mortgage Building. L. B. Dewey, formerly with the Westinghouse Electric & Mfg. Co., is manager.

WANTED—Young engineer, qualified as engineer and estimator in heating and ventilating work, by New York heating contracting firm. Write, giving particulars and salary desired. Address Wilson, care of Heating and Ventilating Magazine.

HOUSE HEATING WINDOW DISPLAY IN NEW YORK SHOWROOMS OF AMERICAN RADIATOR COMPANY.

A new heavy-duty BOILER for large buildings

INSTALLATIONS of low pressure cast-iron boilers for large buildings are rapidly increasing.

Today scores of large apartment houses, schools, hospitals, hotels, theatres, banks and office buildings are receiving adequate warmth at lower operating cost from cast-iron, sectional low-pressure boilers.

THE NEW IDEAL 79″ WATER BOILER is one of the newest products of our Institute of Thermal Research, designed to serve this particular field.

Cast in sections, and assembled in two separate halves yoked together in the rear by single flow and return headers, this new boiler is easily adapted to *any* building. Due to this type of construction, it can be easily installed in old buildings as well as new. It will burn any kind of fuel and may be equipped with an Ideal Smoke Preventing Device.

As the IDEAL TYPE A HEAT MACHINE has proved to be the best heating plant for the fine residence, so this 79″ Boiler, we believe, represents a long stride forward in wasteless efficient heating for larger buildings.

It has so many new and interesting points of construction that a booklet is necessary to present them adequately. We urge every Engineer and Architect interested in heating equipment for this field of construction to send for this booklet today.

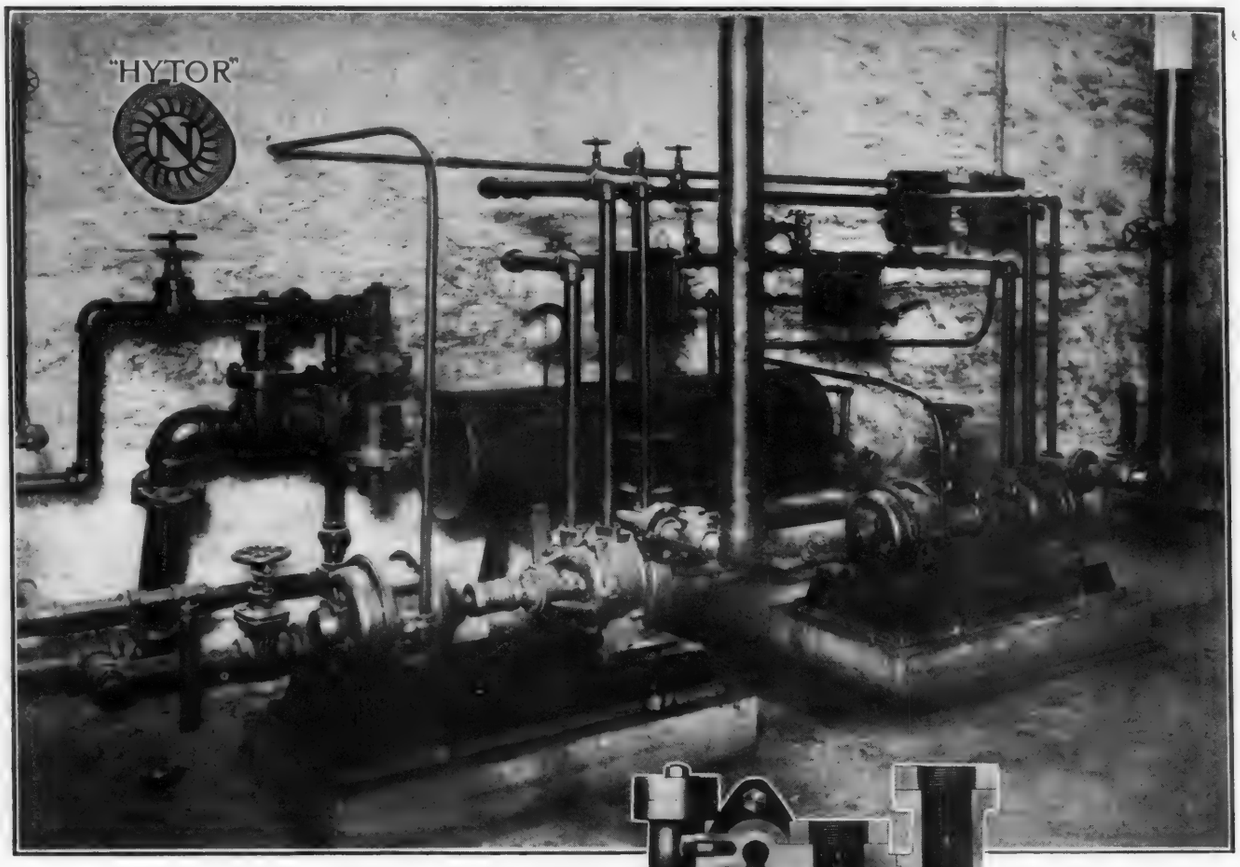
Your name on your letterhead will bring it. Just use the nearest address below:

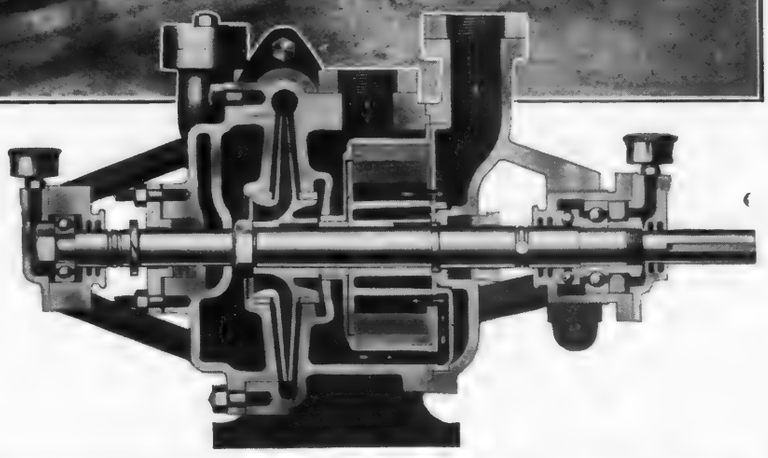
AMERICAN RADIATOR COMPANY

IDEAL Boilers and AMERICAN Radiators for every heating need

104 West 42nd St., New York Dept. 106 816 So. Michigan Ave., Chicago

EFFICIENT HEATING *demands the* JENNINGS PUMP





Duplex "D" Unit Continuous Operation
Willard School, Minneapolis, Minn.

Capacity each pump 40,000 square feet direct radiation air capacity 25 cubic feet per minute in addition to a water capacity of 60 gallons per minute.

The motors are only three horse power

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boilor pressure is against the water only. The air and vapor approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse power is over fifty percent. In other words, the cost of current to operate is cut in half.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mounted outside of casing. Moving parts revolve without contact.

Quiet, reliable operation without annoyance because of shut downs, and minimum of expense for repairs is assured if the Jennings Hytor Vacuum Heating Pump is installed on your Vacuum Heating System.

There are many other reasons why the Jennings is being installed on practically all of the big jobs, Bulletin No. 15 gives them in detail. Write for it.

The NASH ENGINEERING COMPANY

SOUTH NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes.

Heating and Piping Contractors' Boston Association elected the following officers at its recent annual meeting, in Boston: President, Ralph S. Franklin, A. B. Franklin Co., Melrose; vice-president, Herbert A. Snow, Buerkel & Co.; secretary, C. W. Sisson; treasurer, William T. Smallman, Isaac Coffin Co.; Directors: M. E. Chase, Ross Chas Co.; F. F. Cleghorn, Cleghorn Co.; W. T. Cousens, McLean & Cousens Co.; F. W. Howard, Ingalls & Kendirken, Inc.; D. S. Huey, Huey Bros., Inc.; T. A. Ridder, T. A. Ridder & Co.

American Society of Mechanical Engineers will hold its spring meeting in Atlanta, Ga. The festivities will commence at the University of Virginia, May 5 and 6, while the program at Atlanta will start Monday, May 8 and will extend through May 11. The technical program in Atlanta will include papers furnished by the Power, Fuels, Materials Handling, Management, Machine Shop and Textile professional divisions.

January Construction, according to the F. W. Dodge Company's reports, was 49% ahead of the corresponding month last year. The total amount of the contracts awarded in the 27 neartheastern States was $166,320,000. Although this represented a decline of 16% from the previous month, it was the second largest January total on the company's records, having been exceeded only in January, 1920. Residential building accounted for 45% of the January total, amounting to $75,728,000. Business buildings amounted to $23,694,000, or 14% of the total; industrial buildings, $19,695,000, or 12%; public works and utilities $18,735,000, or 11%. Industrial building although small, showed a gratifying increase over the previous month. In New England, the contracts awarded amounted to $16,005,000, a 40% decline from the preceding month, but nearly double the figure for January, 1921. In New York State and northern New Jersey, the figures came to $54,260,000, just two and a half times the amount for January, 1921, but a decrease of 13% from January, 1922. The Middle Atlantic States reported a total of $24,237,000, a decrease of 24% from the preceding month, but a marked increase over the corresponding month last year. In the Pittsburgh district, the figures were $25,966,000, an increase of 16% over the preceding month, and a decrease of 6% from January, 1921. In the central West, building contracts amounted to $42,794,000, 7% under the figure for the preceding month, and 19% greater than the January, 1921, total. In the Northwest the total was $3,058,000, 64% less than that for December and 33% less than January, 1921.

Eastern Supply Association held its winter meeting at the Hotel Astor, New York, February 8, with an attendance of some 300 members. President A. M. Maddock in his opening address voiced the feeling of optimism over business conditions which he had noted on all sides. His views were confirmed by the reports on business conditions made by various members. Among the speakers at the meeting were Frank B. Lasette, former president of the National Association of Master Plumbers, who spoke on the benefits to be derived from coöperation between manufacturer, jobber and retailer

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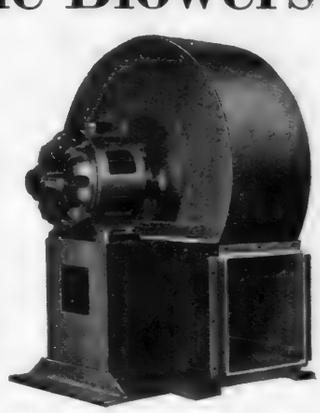
Autovent Fans — and — Uniblade Blowers

Note the accessibility to our protective type Brush Holders for commutator Protection.

ARE REPRESENTATIVE
of every Modern Improvement
known to Electrical and Ventilating Engineering



OUR engineers have constantly kept in mind the importance of Low Power Consumption, Symmetry and Compactness as well as the durability and quietness of operation.

THE finest obtainable materials have been patiently molded into form and skillfully assembled by master craftsmen to render the highest possible efficiencies known to fandom.

There is a size in stock—For your EVERY PROBLEM—
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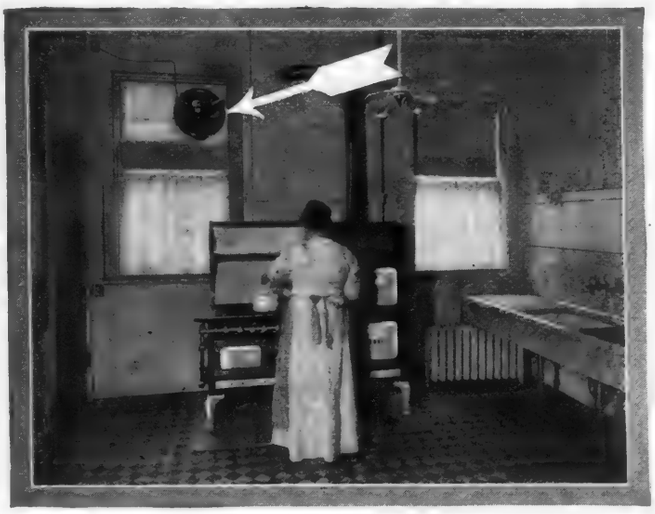
and others, in which he endorsed the work of the National Trade Extension Bureau; and Ralph D. Wilson, general manager of the Babson Statistical Bureau, who spoke encouragingly of business prospects although he urged the utmost caution and energy to secure results.

New York—The so-called Untermyer wage proposal offered to the New York City Building Trades Employers' Association has been rejected by that body. According to the terms of the proposal a new contract was to be made for two years from January 1, 1922, between the employers and the workmen in the building industry at the present wage scale during 1922. It was further proposed that the wage scale for 1923 be based on that of 1922, subject to decrease or increase in cost of living for 1922 as compared with 1921, provided that the continuance of the present wage scale and the amount of the wage scale for 1922 be conditioned as to the wages of $1.00 per hour for each member of the unions, upon the efficiency of each union separately considered. This efficiency was to be determined by an arbitration board of seven members.

Chicago, Ill.—In the final award of Judge K. M. Landis on the building trades wages, those of the steam fitters and plumbers remained unchanged at 95 cents an hour. It was stated by President W. A. Curran, of the Building Trades Council, that the unions would now abide by the judge's decision and go back to work if the non-union men now employed in the building trades were withdrawn. It is expected that the citizens' committee will not compromise on this point on the ground that the union members by violating the terms of the award became outlawed.

Central Supply Association held its eighty-eighth regular meeting at the Hotel Stratford, Chicago, February 15. Following a report by F. T. Hanley, of Chicago, representing a sub-committee of a general committee appointed by Secretary of Commerce Herbert Hoover, on the adoption of a uniform specification which will apply to all material used by the government in its building operations, the association adopted a resolution endorsing the movement and providing also for the establishment of a National Bureau of Standardization. The president of the association was authorized to appoint a committee to coöperate with the commit-



Three times a day---during morning, noon, and evening cooking periods---21 times a week or over a thousand times a year an

ILG ELECTRIC VENTILATING COMPANY — ILGAIR — CHICAGO, ILL.

Kitchen Ventilator will keep cooking odors and greasy fumes from circulating through every room.

The Ilgair is the most useful of Household Appliances. It costs less despite the fact that it is used the most. Send for descriptive circular, also literature on Ilg Self Cooled Motor Fans for other uses.

With the closing of windows and doors during cold weather "Ventilation through the Kitchen" will be eagerly sought by every home owner. Contractors can sell many Ilgairs right now.

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

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Quick Opening

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The **ONLY Packless** and **Modulated** Valves in which the **Packless Feature,** although a **positive seal within itself** and **practically indestructible,** is, through a packing cushion and a very heavy special spring, **automatically re-enforced,** providing **two or double, independent, positive,** bonnet seals at **all times.**

These valves will withstand high pressures and, therefore, are of **superior value** for **vacuum** and **low pressure service.**

We specialize on high grade Radiator Valves and furnish the largest line of any company in the business

Printed matter and prices on application

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REG. U.S. PAT. OFF.
TRADE JENKINS MARK
Jenkins Bros.

"Genuine"

Discriminating users, the country over, are insisting on the valves that they know are the original and true stock — genuine Jenkins. Every Jenkins Valve is easily identified by the Jenkins "Diamond Mark" and signature which are cast on the body. Know this mark and demand the valves that are a standard of dependability and service.

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"Buffalo" Heating and Ventilating Equipment

THE Cleveland Discount Company building, lifting its head among its lofty neighbors, is a fitting item in the growth of the wonder city of the Lakes.

Buffalo Fans and Carrier Air Washers will help to make its banking rooms and vaults fresh and pleasant.

The same appropriate selection of apparatus will serve the same high purpose in the new Public Auditorium. The Federal Reserve Bank, Keith's Theater, and Wade Park Manor Hotel, to mention only a few of our Cleveland orders.

Buffalo Forge Company

Buffalo **New York**

tee of the Department of Commerce. Professor George C. Whipple, is the chairman of the Plumbing and Heating Division of the Department of Commerce committee. Fuller support of the work of the National Trade Extension Bureau was provided for in a resolution authorizing the president to appoint a more general committee representing the various States to secure both financial coöperation and a more widespread interest in the work. William J. Woolley, the manager of the bureau, made a suggestive talk along these lines. In the afternoon Charles Piez, president of the Link-Belt Company, and a member of the executive committee of the Citizens' Committee to Enforce the Landis award, spoke on "The Building Industry in Chicago and Surrounding Territory." In the discussion of business conditions, both manufacturers and jobbers expressed a feeling of greater hopefulness than has been evident in several years.

Chicago, Ill.—Two officials of the master steam fitters' association, a business agent and three heating contractors have been indicted in Chicago for conspiracy to "fix" the prices of heating plants. The indictments were returned secretly by the special grand jury which has been investigating the Dailey Commission charges. Those indicted are Charles Glennon, secretary of the Master Steam Fitters' Association; his assistant, Lewis T. Braun; Charles M. Rau, business agent of the Steam fitters' union; W. A. Pope, heating contractor; Robert Wray, contractor; and John R. Kehm, contractor. The specific charges were in connection with the heating contract for the building of the of the Central Coal Storage Company.

Dwight P. Robinson & Co., New York, has been given the contract for the construction of the exposition building to house the exhibits of the United States at the Brazilian Exposition next September. It is stated that the building will be of permanent construction and will be converted later into an embassy for this country's diplomatic representative after the close of the exposition.

New York.—Shippers of the country made a score of 99.1% in the "Perfect Package Campaign" according to a recapitulation of results of the movement inaugurated by the Joint Campaign Committee of the American Railway Association and the American Railway Express Company. During the "Perfect Package Month," as November was designated, the railroads were credited with handling 9,339,745 freight shipments. During the same period the express companies handled 10,899,352 shipments.

Washington, D. C.—F. M. Feiker, who for the past eight months has been assisting Secretary of Commerce Herbert Hoover in the reorganization of the Department, has resigned. He has not, however, completely severed his connection with the Department, but will serve as a special agent of the Bureau of Foreign and Domestic Commerce. Under the direction of Mr. Feiker, who is vice-president of the McGraw-Hill Company, of New York, and Dr. Julius Klein, director of the bureau, the industrial and business contracts of the bureau have been greatly enlarged, business relations with trade association committees established and so-called Commodity Divisions of the bureau established.

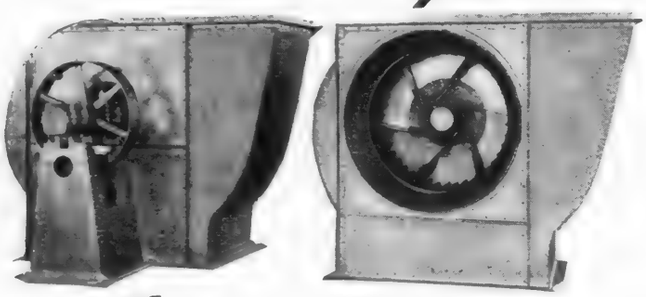
National Association of Building Trades Employers, at its annual convention in Cleveland, O., January 12, re-elected Walter Klie as president.

National Trade Extension Bureau's officers for the coming year, as elected at a meeting of the bureau's board of directors, in Evansville, Ind., January 16-17, are as follows: President, Joseph W. Cannon, Chicago; vice-president, A. M. Maddock, Jr., Trenton, N. J.; treasurer, L. C. Huesmann, Indianapolis; secretary-manager, W. J. Woolley.

Central Station Heating Notes.

Aurora, Ill.—Petitions have been filed with the Interstate Commerce Commission by Corporation Counsel Maurice F. Lord, asking that gas, steam heat and telephone rates in Aurora be reduced. In effect, the petitions ask that the steam heat rates be reduced considerably and a rebate given consumers. The present rates, which were established in October, 1920, start at $1.05 per 1000 lbs. for the first 25,000 lbs. decreasing until the amount of 150,000 is reached. The flat rate is 63 cents per season per foot of required radiation.

Cleveland, O.—A survey of the muni-



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MULTIBLADE FANS

Where large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior, to any other fans on the market.

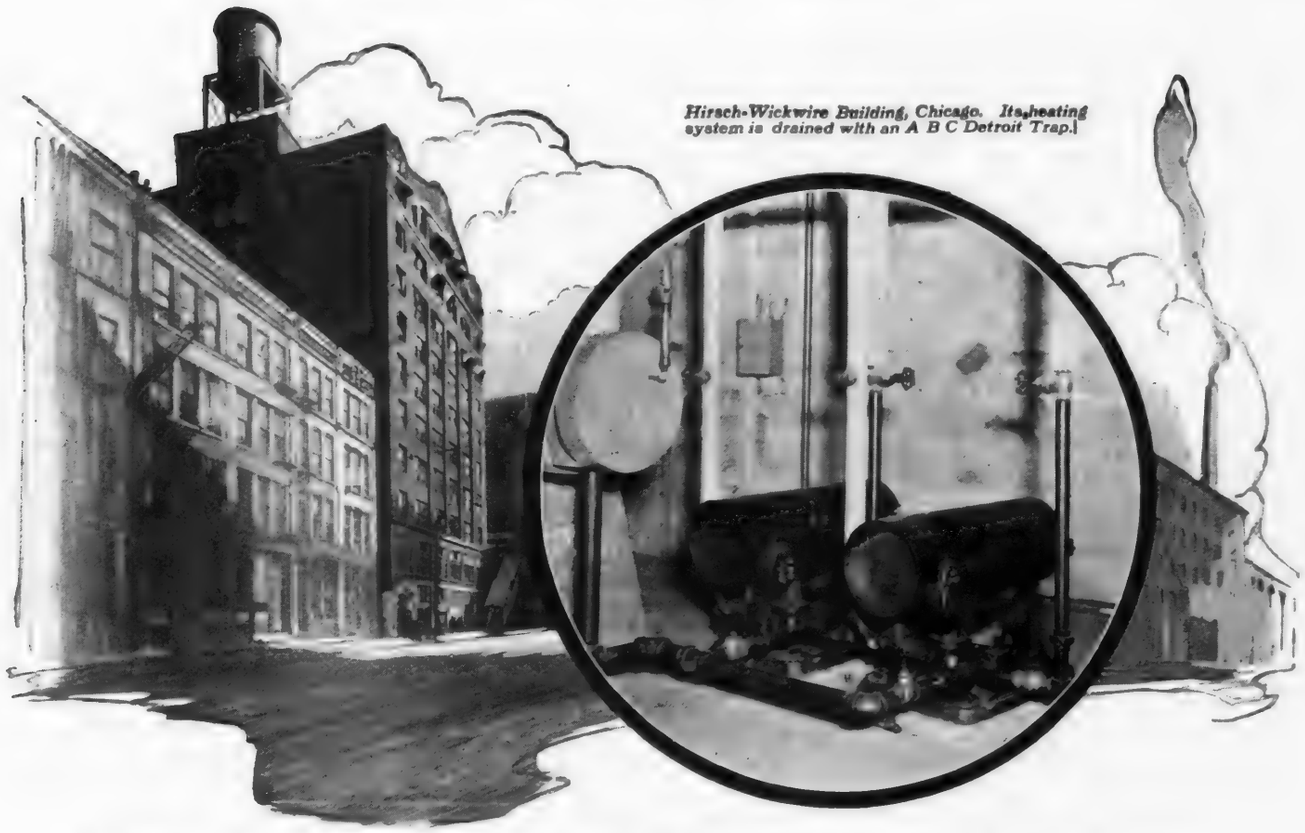
A study of the capacity tables and characteristic curves in the Lehigh catalogue clearly proves this fact.

To further substantiate this statement, your attention is directed to the large inlet and outlet, the cone shaped hub, the absence of stay-rods, the rigid construction secured by special blades running tangent from the hub to the periphery of the wheel and also various other details.

May we send you a copy of our catalogue?

HERSH BROTHERS CO.

654 Mill Street ALLENTOWN, PA.



Hirsch-Wickwire Building, Chicago. Its heating system is drained with an A B C Detroit Trap.

Keep Your Steam Heated Equipment at High Temperature—Return Your Condensation Direct to Boilers and Eliminate Pumps—Save 15 per cent of Coal

Steam drainage equipment if properly installed, will keep your steam-heated machinery and apparatus at high temperature and speed up production.

Efficient steam drainage is made certain with the A B C Detroit Trap System which returns the condensation at high temperature direct to your boilers.

By returning the condensation to boilers, without the aid of pumps, a fuel saving is effected because it is not necessary to allow the condensation to cool to 212 degrees—the highest temperature at which the condensation can be handled by pump.

If you are operating a plant with steam power—if you have a steam drainage problem—bring it to the attention of our engineers. Let us demonstrate that with the A B C Detroit System you will not only increase your production but you will also lower your fuel cost at least 10 per cent. Write for our booklet completely describing the A B C Detroit System.

AMERICAN BLOWER COMPANY, DETROIT

BRANCH OFFICES IN ALL PRINCIPAL CITIES

CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

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"Sirocco" Products

BLOWERS · EXHAUSTERS · VENTILATING FANS · AIR WASHERS · ENGINES

FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

cipal heating plant has been begun by G. W. Knisely, who has been appointed a special engineer by Utilities Director Arthur B. Roberts, to learn if the plant is being operated at a loss, as has been reported, and, if so, to find a remedy.

Edwardsville, Ind.—The Southern Illinois Light and Power Company has been looking over the electric light and power situation in Staunton and is considering submitting a proposition to take over the plant and furnish the city with electric current for light, power and heating purposes.

Tacoma, Wash.—Electric heating of homes in Tacoma through the sale of the excess power load of the Tacoma Lighting Company has been made the subject of a recent bulletin issued by the Engineering Experiment Station of the University of Washington. Tacoma with its rate of ½ cent per kilowatt hour for heating, with a minimum charge of $9.00 per kilowatt of maximum demand, is credited with the lowest rates for domestic electric power in America. The city also has the largest application of electrical heating for homes on the continent, it is asserted. The growth in the use of electricity for house heating has been from 546 at the close of 1919 to 925 in 1920, or 69% increase, while the number of installations since that time have increased the percentage to 300%. The connected load during the same period has increased from 3625 to 6104 kilowatts.

In going into the heating rate offered by Tacoma and the use made of electric heating in Tacoma homes, the bulletin takes occasion to quote authorities to the effect that electrical energy cannot be expected ever under present conditions to compete in a general way with fuel heating, as no electrical plant can afford to sell more than otherwise waste power at rates low enough to compete, and agrees with this opinion.

In discussing the reason for the low heating rate made, the University report has the following to say:

"Instead of being its principal load, Tacoma's heating business is and should be looked upon as in the nature of an excess or surplus power load. In 1914 the City of Tacoma, finding itself with a hydroelectric plant on its hands having a capacity considerably in excess of that demanded by existing or immediately prospective power and lighting requirements of the city, was confronted with the alternative of either letting the excess energy go over the dam unused, or stimulating additional demand for it outside of the ordinary channels. The domestic heating load offered possibilities of large additional loads if rates could be established which would make it economically possible. Such a rate would have to be low enough to encourage the use of considerable electrical heating and still high enough to maintain coal and wood in a strongly competitive position from the standpoint of cost, so as to prevent the general adoption of the electric method. Up to the present time the half-cent rate seems to have accomplished this result. It is questionable, however, whether with present prices of coal, the heating rate could not well be somewhat higher.

"One other factor which has an important bearing on rates for domestic power is the fact that the domestic power load and the industrial power loads are largely supplementary, that is, they require generating machinery capacity at different hours during the 24-hour period."

It is the contention of opponents of the city's heating rate that while the sale of domestic current for heating improves the daily load factor, that is, tends to extend the hours of heavy demand backward in the day from the evening peak to early morning hours, it nevertheless causes a poorer yearly load factor because the greatest heating demand comes in the winter months at the same time the lighting demand is the heaviest, leaving the summer minimum demand or "valley" relatively deeper in comparison with the winter "peak," which represents the developed capacity which an electric plant must have. They contend all domestic heating, and some include cooking, as ruinous at city rates.

The University report shows that the demand for domestic heating power extends throughout the year, declining to 1% of the total year demand in July, when water heaters probably account for most of the use of current; while the six-month period from April to September, inclusive of both months, accounts for 25% of the total demand.

The city light department heads contend that they can assume a certain percentage of domestic heating without detrimentally

Just one of the TWENTY-FOUR PUBLIC SCHOOL BUILDINGS AT AKRON, OHIO
equipped with

BUCKEYE FANS AND SPECIALTIES.

We furnished the fans, dampers, registers, grilles, and faces for the above buildings.

Why not use our catalogs and prices?

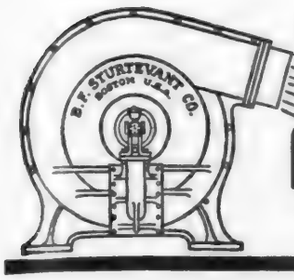
BUCKEYE BLOWER COMPANY

COLUMBUS, OHIO

Cleveland, Ohio
Toledo, Ohio

Atlanta, Ga.
Pittsburg, Pa.

Cleveland, Ohio
Chicago, Ill.



Sturtevant

REG. U.S. PAT. OFF.

PUTS AIR TO WORK

FRANKFORD HIGH SCHOOL, PHILADELPHIA, PA. *J. Horace Cook, Architect*

Equipped with Sturtevant fans and air-washers

SCHOOL VENTILATION

THE large number of people interested in schoolhouse design from different angles is responsible for the various theories constantly being offered architects and schoolboards with regard to school ventilation.

The whole subject can be reduced to the problem of giving the students fresh, clean air in proper volume and at a comfortable temperature. Years of close study have proved to us nothing better than washed air distributed by a fan system readily controlled as to temperature and volume.

The best evidence of the correctness of our views is the large number of important city schools, erected with the best architectural and engineering advice in which

Sturtevant Equipment

is chosen for the ventilating system.

Experimental work involving the expenditure of public funds should not be permitted, as heating and ventilating constitute the most important details of the mechanical equipment of schools. The research work of the school authorities and engineering societies of our large cities points out the simple, practical way.

Competent engineers in our twenty-four branch offices will gladly consider your problems in schoolhouse or other building plans

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASS.

STURTEVANT BRANCH OFFICES

ATLANTA, GA. 306 Walton Bldg.
BOSTON, MASS. 555 Mass. Trust Bldg.
BUFFALO, N. Y. 100 Bedford Ave.
CHICAGO, ILL. 530 So. Clinton St.
CINCINNATI, OHIO 610 4th National Bank Bldg.
CLEVELAND, OHIO 436 Guardian Bldg.
DALLAS, TEXAS 3411 Knight St.
DETROIT, MICH. 3000 Grand River Avenue
HARTFORD, CONN. 36 Pearl Street
KANSAS CITY, MO. 707 Mutual Bldg.
LOS ANGELES, CALIF. 411 Hollingsworth Bldg.
MINNEAPOLIS, MINN. 804 Met. Life Bldg.
NEW YORK, N.Y. 52 Vanderbilt Ave.
PHILADELPHIA, PA. 135 No. Third St.
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ST. LOUIS, MO. 2086 Railway Exch. Bldg.
SALT LAKE CITY, UTAH 818 McIntyre Bldg.
SAN FRANCISCO, CALIF. 759 Monadnock Bldg.
SEATTLE, WASH. 1105-1106 White Bldg.
WASHINGTON, D. C. 1006 Loan & Trust Bldg.
B.F. STURTEVANT CO. OF CANADA, LTD. GALT, ONT
MONTREAL 404 New Birks Bldg.
TORONTO 210 Lumsden Bldg.

affecting the system's yearly load factor, in combination with lighting, cooking, water heating and industrial power loads, and at the same time increase the total sales of current and the consequent profits of the plant. Thus far the domestic heating has not been in excess of the other elements of demand they believe, but they are still studying and experimenting to determine what percentage of heating the system can actually stand.

Manufacturers' Notes.

Stark Sheet Metal Works Co., Canton, O., announces that W. B. Crawford, formerly with the Massachusetts Fan Company as Cleveland representative, has been appointed Illinois representative for the Stark Sheet Metal Works Co., manufacturer of the Mack ejector and Airomatic ventilators and the Perfecto damper regulator and indicator. Mr. Crawford will make his headquarters in Chicago, at 501 Tacoma Building. It also announced that the company's products are now being handled in Pittsburgh by B. A. Geier, 230 Fifth Avenue, Pittsburgh.

Crane Co., Chicago, Ill., has opened new branch offices in Lima, O. and in East Chicago, Ind. The company's new warehouses in Pittsburgh and New Orleans, it is stated, are nearing completion.

Utica Heater Co., Utica, N. Y., held its annual sales convention in Utica, January 10-12, at the Hotel Utica. Fifty of the company's representatives were present. Among the topics taken up at the five regular business sessions were general problems in heating, practical installation problems, important phases of salesmanship, territory development and prices and terms. The three-day convention wound up with a dinner at the Hotel Utica.

Abram Cox Stove Co., Philadelphia, Pa., announces the election of the following officers at the annual meeting of the company, held February 15: President, A. C. Mott; vice-president, A. C. Mott, Jr.; E. S. Dean, treasurer; E. F. Glore, secretary; Walton Pennewill, general counsel. Mr. Glore was formerly general sales manager of the company and his many friends will welcome his return to the company in an executive capacity.

Trane Co., manufacturer of the Trane heating specialties and originator of the Trane system of vapor heating, announces that its advertising department has been transferred from the Chicago branch to the home office in LaCrosse, Wis. This action has been taken to facilitate a broadened advertising program—including increased space in trade papers and extensive direct-by-mail work—which has been made possible by the rapidly increasing demand for its products. L. A. Trumble will be in charge of the work. He was formerly in the advertising department of the Commonwealth Edison Company of Chicago.

Hart & Crouse Co., Utica, N. Y., has appointed Martin A. Rooney vice-president and manager of sales. Mr. Rooney was formerly manager of the Detroit branch of the American Radiator Company.

H. W. Nelson Corporation, Moline, Ill., is the name under which Moline Heat will be known hereafter. The company, it is stated, will continue under the same management to manufacture and sell the Univent and Moline Heat, but as two distinct and separate products. Six years ago the Moline Heat system of steam circulation was marketed under the firm name of the Moline Vapor Vacuum Company being changed at that time to Moline Heat.

Wilson Welder & Metals Co., Inc., 132 King St., New York, manufacturer of arc welding machines and certified welding metals, announces the appointment of R. L. White as district manager in charge of the Detroit office, 809 Kresge Building, Detroit.

Hoffman Specialty Co., Waterbury, Conn., held a notable convention of its sales force during the week of January 23-28. The sessions on the first four days were held at the Hotel Biltmore, in New York and the remaining sessions at the company's plant in Waterbury. George D. Hoffman, president and founder of the company, presided. Following the first session, on the 23rd, a dinner was held at the Biltmore, which was attended by some 40 heating and plumbing men, in addition to the company's representatives. The speakers included C. V. Haynes, the new vice-president and general sales manager, who discussed the sale of Hoffman products by the jobber; Mr. Hoyt, of Hoyt's Service, New York, who discussed the company's advertising campaigns; and Mr. Parlin, statistician of the Curtis Publishing Company, Philadelphia, who emphasized the upward trend in business conditions. The last two days were spent at the company's plant in Waterbury.

Among those who attended the convention were George D. Hoffman, president; Charles V. Haynes, vice-president and general manager; W. K. Simpson, secretary; E. S. Storm, vice-president, Chicago; F. H. Gaylord, Minneapolis; F. C. Reeder, Knoxville, Tenn.; J. W. Crossley, Erie, Pa.; R. R. Emerson, New York; J. K.. Peacock, New York; G. A. Suits, Boston; Edward F. Pierce, Jr., Boston; H. F. Hobby, New York and William Bowles, Chicago.

Whitlock Coil Pipe Co., Hartford, Conn., announces the appointment of George D. B. Van Tassel to represent the company's interests in Detroit, Mich., and vicinity. Mr. Van Tassel, who is known as a superheater expert, will specialize in this field in connection with the company's line of heat exchange apparatus, including the Whitlock all steel superheater which was recently placed on the market.

New Incorporations.

Anderson Magnesia Products Co., Boston, Mass., capital $100,000, to manufacture and deal in magnesia and asbestos products. Incorporators: James G. Anderson, James G. Anderson, Jr., and Nochiro Saito, all of Boston.

Domestic Oil Heating Co., Boston, Mass., capital $25,000, to manufacture oil-heating equipment. Directors: J. Frederick Mann and Paul Barron Weston, Jr., of Boston, and George R. Rowell, of Cambridge, Mass.

Ketchum Heating Co., Chicago, Ill., capital $15,000, to manufacture and deal in heating and plumbing materials. Incorporators: Louis Slinger, James T.

Vento Return Line Valve

for Vacuum and Vapor Heating Systems is a fuel-saver from the moment that it is put to work on the heating system. It never fails in its promise to make the heating system give dollar-for-dollar service for every ounce of fuel consumed. Our latest Booklet, "The Perfect Heating System," will be mailed on request to any heating engineer.

WM. S. HAINES & COMPANY
PHILADELPHIA

Steam Traps Steam Separators Oil Separators Strainers
Air Traps Exhaust Heads Boiler Alarm Water Columns

WRIGHT AUSTIN

Standard with STEAM USERS SINCE '94

WRIGHT-AUSTIN CO. DETROIT, MICHIGAN

Peerless Ventilator

BUILT RIGHT RUN RIGHT

The New York Blower Co.

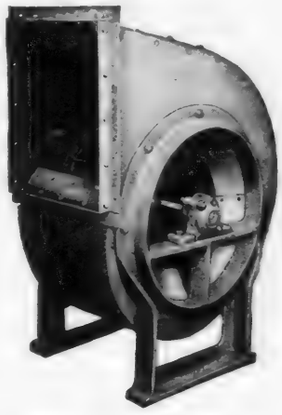
Chicago, Ill. La Porte, Ind.

Peerless Air Washer

We manufacture a complete line of fan equipment and appurtenances. By concentrating on this one class of products we are able to make them better every year.

Pulley Driven Disc Fan for Mines

The old fallacy that fan equipment was a luxury is now known to be untrue; it is an economical necessity. We can give actual installations in all kinds of industries where through the wise employment of fan equipment manufacturers have improved the quality of their product, and increased production with a reduction in factory cost.



Type "C" Seri-Vane Fan

If you are interested in drying, humidifying, heating, ventilating, mechanical draft, removal of shavings or similar installations, please communicate with us. If we cannot honestly prove facts to you showing the benefits that will follow from an installation for your special problem, we will frankly so state.

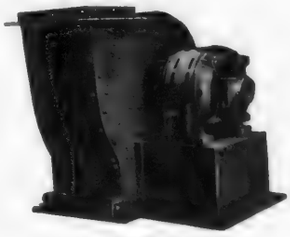
Motor Driven Propeller Fan

Slow Speed Planing Mill Exhauster

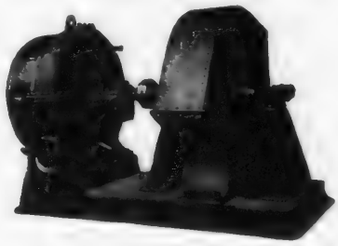
The New York Blower Co.

Chicago, Ill. La Porte, Ind.

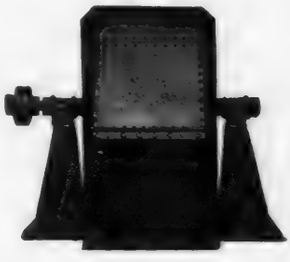
Branch Offices in Principal Cities



High Speed Type "C" Seri-Vane Fan



High Pressure Blower Direct Connected to Turbine



Stoker Fan

Ketchum, Marcus Weil. Correspondent, Louis Slinger, Harris Trust Building.

Locken Heating Co., 4123 West North Ave., Chicago, Ill., capital $5,000 to conduct a heating and plumbing contracting business. Incorporators: Rose Herbert, Marie Needham and Charles E. Green. Correspondent, Green, Beverly & Rice, 30 North La Salle St.

Elger Heating Corporation, 926 Ridge Ave., Evanston, Ill., capital $25,000, to manufacture and deal in heating apparatus and systems. Incorporators: Joseph Elger, Ross Elger, Amy Goda and Herman G. Goda. Correspondent, Kixmiller and Barr Baar, 20 East Jackson Boulevard.

G. U. Ladd Co., Worcester, Mass., to take over the business of Geo. U. Ladd & Co. The new corporation will continue the policy of the old company and with increased facilities is planning for a much larger production of the Ladd receiver-pumps for vacuum, vapor and low-pressure heating systems. George U. Ladd is president and general manager of the corporation and George D. Morse, treasurer.

Contracts Awarded.

Latourette-Fical Co., Sacramento, Cal., heating and ventilating the new Junior high school and gymnasium in Petaluma, for $20,700 with a cast-iron boiler; $21,350 with a Pacific type; and $21,450 with a Kewanee boiler. Other bidders were (based on use of cast-iron boiler): J. Collins, $24,612; Uppen, Hanley & Thing, $23,777; J. E. O'Mara, $23,600; F. J. Klimm, $22,388; W. K. Nottingham Co., $23,777; Scott Co., $22,920; Turner Co., $26,480; Bay Engineering Co., $23,015; C. F. Doell, $22,346; and United Cashel Co., $22,693.

McMahon Plumbing & Heating Co., Seattle, Wash., heating and ventilating Columbia School, in Seattle, for $22,300; the plumbing contract went to the Dupar Blythe Company at its bid of $11,482.

Portland, Ore.—Bids for the heating and ventilating plant at the new Multnomah County Hospital were as follows; Alaska Plumbing & Heating Co., $53,880; W. S. Fleming, $54,265; Rushlight & Hastorf, $54,750; Kraft Co., $57,750; Fox Co., $59,687.

Nathan Miller & Sons, Ltd., Fall River, Mass., heating Fall River Municipal Hospital for $64,450. Oil-burning heating equipment will be installed. The other bids, exclusive of the deductions for coal heating, were as follows: American Plumbing & Heating Co., $74,867; Cleghorn Co., Boston, $63,400; McMurrer Co., Boston 64,000; Lord Construction Co. Boston, $62,866; Edmund T. Keefe, Boston, $63,623; John F. Johnson Co., $66,990; Lagasse Bros. Co., $78,000; Almirall & Co., New York, $66,011; M. J. Daly & Sons, Waterbury, Conn., $78,720; Simplex Oil Heating Co., Providence, R. I., for installation of oil-burning equipment, $8,450 and $7,950.

New Firms.

Arthur Service Co., 409 Empire Building, Pittsburgh, Pa., has been organized by H. W. Arthur, to conduct a business as manufacturers' agents and as heating and plumbing engineers. Mr. Arthur, the head of the company, has had an experience of over 20 years as heating and plumbing salesman, engineer and manager. During the last few years he has made a specialty of vapor heating and has several hundred installations to his credit. Manufacturers of heating, power and plumbing equipment are asked to send the new firm their catalogues and prices.

P. Gormly Co., Philadelphia, as a partnership of William A. Carroll, James H. Brennan and Harry G. Black, has been dissolved, and the business will be conducted under the same name and at the present address, 155 North 10th Street, by Harry G. Black. Mr. Black is the treasurer of the Heating and Piping Contractors' National Association.

Juttner Heating Co., 198-202 Milwaukee St., Milwaukee, Wis., has been organized by Otto J. Juttner, to engage in contracting engineering work for heating,

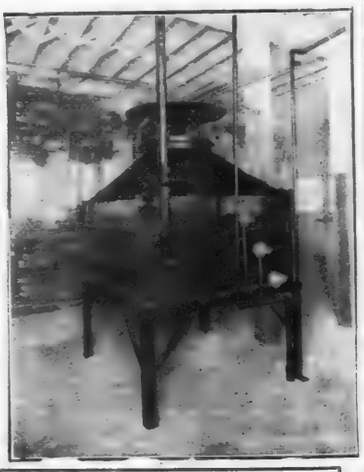
MASSACHUSETTS
Squirrel Cage Fans

Are of heavy construction throughout, insuring long life and freedom from repairs

Massachusetts Blower Co.
Watertown, Mass.
Sales Offices in Principal Cities

WING-SCRUPLEX REG. U.S. PAT. OFF.
UNIT HEATERS

comprise a system of heating any Mill, Factory, Foundry, Garage, etc., which insures a thorough distribution of heated air at the working level without the aid of large, expensive distributing ducts or pipes. In addition to being more efficient, it costs less to install, and is more economical to operate than any other system of heating.



Above photo shows floor (steam) type heater with one style of distributing diffuser.

Wing-Scruplex Unit Heaters are simple, portable, self-contained heating and ventilating units, built in several sizes, in Floor, Ceiling and Wall Types, Steam or Direct-fired, completely assembled before shipment. Briefly, each consists of—
1. A highly efficient heating element,
2. A substantial housing and supporting frame,
3. A properly designed diffusing nozzle, and
4. A powerful Wing-Scruplex (*Screw-propeller*) *Fan.*

Write for our Engineers' Data Book!

L. J. Wing Mfg. Co.
Fans and Blowers (all types)
Damper Regulators Small Turbines
HUDSON and 13th STREETS, NEW YORK CITY

ANNOUNCING

a new and more pleasing line of Packless Radiator Valves

"Genuine Detroit"

PACKLESS RADIATOR VALVE
Bellows Type

Made in sizes from one-half to two inches in Angle, Corner and Globe Types

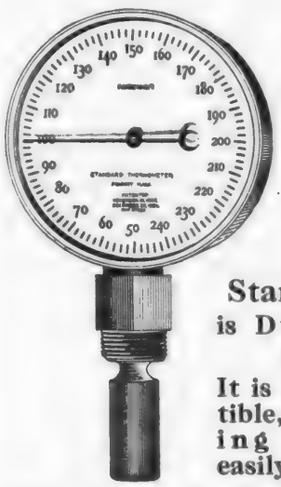
Stocked by leading jobbers

Write for printed matter

DETROIT LUBRICATOR COMPANY.
DETROIT, U.S.A.

STANDARD "Metallic" THERMOMETERS

INDICATING AND RECORDING



ANGLE OR STRAIGHT STEM

WARRANTED ACCURATE

The Standard "Metallic" is Durable, Dependable EASY TO READ

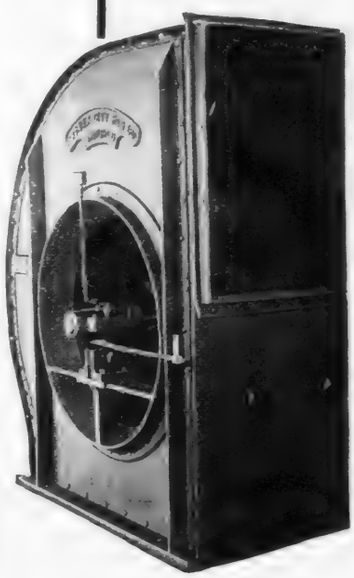
It is practically indestructible, is sensitive to changing temperatures, and easily installed.

Made in a variety of sizes and models for vacuum, steam and hot water systems, bake ovens, cold storage plants and other industrial purposes. They are strictly high grade in every respect, and should be specified where quality is a factor. A line from you will bring booklets illustrating **Standard "Metallic" Thermometers.**

STANDARD THERMOMETER CO. CLIFTON ST. BOSTON 19, MASS.
Nearly Forty Years As Thermometer Manufacturers

Cycloidal MULTIVANE FANS
TRADE MARK

FULFILL THE OBLIGATIONS OF ENGINEERS AND CONTRACTORS TO THE USER.



Pat'd May 26, 1908

A GENUINE COMBINATION OF EFFICIENCY *AND* DURABILITY

The result of over 40 years of constant experience

A fact that demands your attention:—

"WHEREVER INSTALLED"

Cycloidal Multivane Fans Receive Unsolicited Praise and Recommendation from Architects, Engineers, Contractors and Users.

Sectional Catalog No. 20 is yours for the asking. Contains Capacity tables, dimensions, etc.

GARDEN CITY FAN CO.

Established 1879

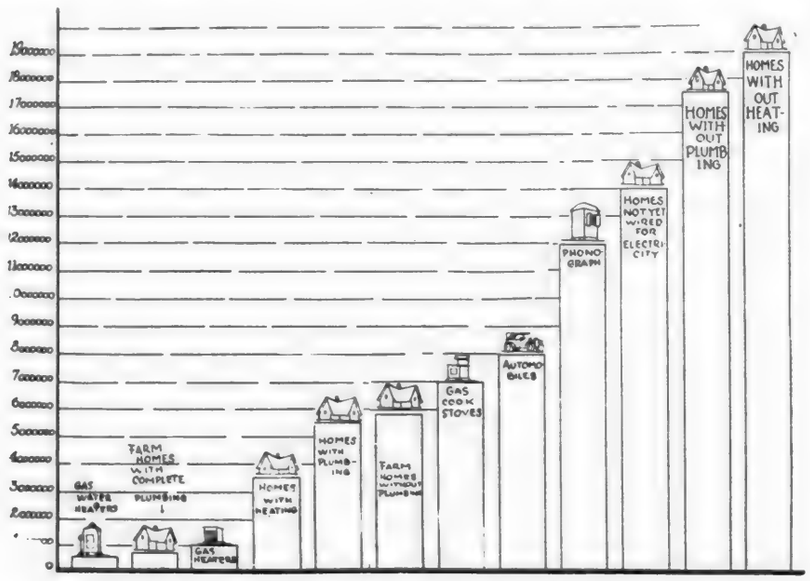
McCormick Bldg. CHICAGO, ILL.

COCHRAN & WRIGHTSON
47 W. 34th St.,
New York City

ventilating and power. The business will be under the direct, personal management of Mr. Juttner, who has been connected with this line for the past 25 years. He has been secretary and engineer for the General Heating & Ventilating Company since its organization in 1914.

Prospective Business in the Heating and Plumbing Trades.

A graphic idea of the possibilities for those engaged in the heating and plumbing industries is presented in the accompanying chart which appears in the *Monthly Service Bulletin* for January, 1922, of the National Trade Extension Bureau. As the *Bulletin* points out, there is a building shortage at the present time estimated at 1,500,000 houses, 600,000 apartment buildings, 500,000 factories, 5,000 churches, 15,000 theatres, 5,000 schools, and so on, practically a total of 2,600,000.



Of almost equal importance, however, is the need of remodeling existing buildings, including the installation of new heating equipment. In connection with the accompanying chart, special attention is directed to the large number of automobiles, totaling, 8,000,000 as compared with 5,000,000 bathrooms and 3,000,000 modern heating plants; also 12,000,000 phonographs as compared with only 505,000 gas water heaters. The moral drawn is that there are endless opportunities for increasing the business of both the heating and plumbing contractors.

Indictment of New York Heating Firms.

Heating contractors in New York City, as well as labor officials, were indicted recently by the Grand Jury on charges arising from the Lockwood Committee's investigation of building conditions. The indictment of the 21 corporations and 24 individuals in the heating contracting business were specifically for violating the Donnelly anti-trust law in agreeing to "fix" prices and prevent competition in the installation of heating and ventilating apparatus.

Those included in the list are:

Almirall & Co., Inc., 1 Dominick St., Juan Almirall.

Baker, Smith & Co., 576 Greenwich St.

Child & Scott Co., 112 Wooster St., Ernest T. Childs.

A. B. Barr & Co., 30 East 42d St., Robert J. Currie.

Callahan-Kingsley Co., Inc., 343 West 52d St., Edwin H. Kingsley.

Raisler Heating Co., Inc., 129 Amsterdam Ave., Samuel Raisler, Louis K. Berman.

Reis & O'Donovan, Inc., 213 West 28th St., Wallace M. Hyman.

John C. Williams, Inc., 233 Broadway, John C. Williams.

W. L. Fleisher & Co., Inc., 31 Union Square, Walter L. Fleisher.

Johnston Heating Co., 131 East 26th St.

Wolff & Munier, Inc., 405 Lexington Ave., Richard A. Wolff.

Lazette & Murphy, Inc., 238 West 108th St., Jeremiah L. Murphy.

Wm. G. Cornell & Co., 4th Ave. and 17th St., Edward Slosson.

Miller & Brady, Inc., 210 East 38th St., Robert B. Miller.

McQuillin & Chave, Inc., 198 11th Ave., Walter E. Chave.

W. K. Morgan & Co., Inc., 405 Lexington Ave.,

Wells & Newton Co., Inc., 292 Avenue B, Andrew J. Fee.

Teran, Mahany & Munro, Inc., Grand Central Terminal.

E. Rutzler Co., Inc., 404 East 49th St.

Adams, Britz & Co., Inc., 1,761 Park Ave., Edwin G. Britz.

E. G. Woolfolk & Co., 15 West 38th St., Joseph G. Geoghegan, Leonard G. Kirk, Louis D. Paul.

William L. Olvany, 100 Charles St.

Daniel J. Rice, 405 Lexington Ave.

Albert M. Chambers, 222 East 41st St.

William K. McKiever, 247 West 13th St.

John T. Hettrick.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

Wanted—Experienced steam heating and steam specialty salesman to represent long-established vacuum and vapor heating manufacturer. Commission basis. Some good territory open. Apply giving full experience, territory desired, lines

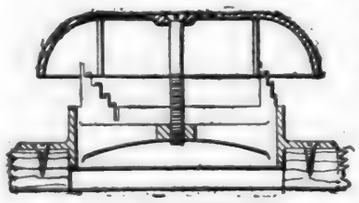
FOR SALE.

AUTOMATIC SPRINKLERS.
GRINNELL APPROVED.

J. W. Yates, 168 Eighth Ave., New York City.

Wanted—District sales representatives to handle line of blast heating and ventilating and air conditioning apparatus as side line, or otherwise on liberal commission. State experience and qualifications. Address Box 12, care of Heating and Ventilating Magazine.

FRESH AIR for THEATRES
AND ALL AUDITORIUMS



The "Notch" Diffuser will distribute the air uniformly.

It is easily adjusted to different openings and locked.

PATENTED

Made of Cast Iron and for either wood or concrete floors
ALSO AISLE HOODS DAMPER AND SCREW TYPES

Knowles Mushroom Ventilator Co.

Telephone: Cortlandt 2090 202-204 Franklin St., New York

AIR CONDITIONING TRADE MARK

APPARATUS for maintaining artificial atmospheric conditions in industrial plants.

ATMOSPHERIC
CONDITIONING CORPORATION
LAFAYETTE BLDG.
PHILADELPHIA

Westinghouse

The selection of Westinghouse Motors for the Ventilating fans in the new Bankers Trust Company Building of New York is in keeping with the high standard of equipment used throughout the structure.

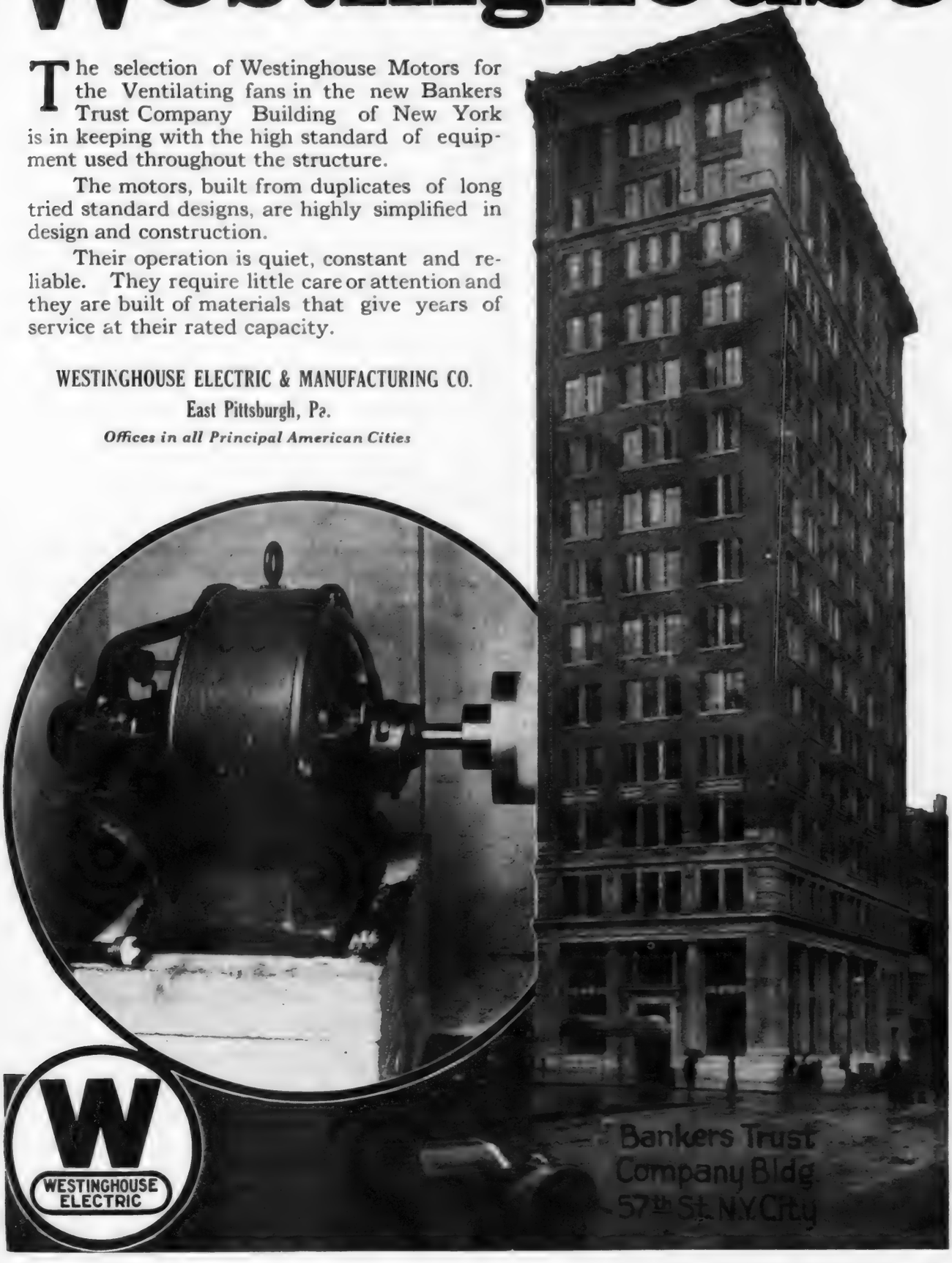
The motors, built from duplicates of long tried standard designs, are highly simplified in design and construction.

Their operation is quiet, constant and reliable. They require little care or attention and they are built of materials that give years of service at their rated capacity.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.

East Pittsburgh, Pa.

Offices in all Principal American Cities



THE DOUGLASS HUMIDIFIER

STANDARD TYPE
Made in three sizes for direct connection to steam piping

Is attached directly to the steam heating system

Discharges dry steam noiselessly

Gives satisfactory results in any type of building equipped with steam

Inexpensive to install

Will not get out of order

No attention required

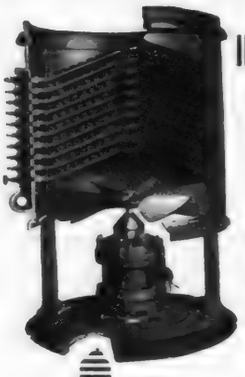
No maintenance expense

Made in various sizes and types to suit all conditions and requirements

Illustrated catalogue sent on request

THOMAS J. DOUGLASS & CO.
441 N. Dearborn St.
Chicago, Ill.

RADIATOR TYPE
Is attached to steam radiator in place of the air valve.
Made in one size only.



A Convenient Heating Unit

easily installed for either temporary or permanent heating service.

Bayley B. T. U.

is a complete selfcontained heating unit with a heating surface consisting of individual spiral radiator coils one above the other (individually valved if desired). Heat is uniformly distributed by forcing the cooler air along the floor line through these coils by means of an electrically driven fan, thus creating a steady stream of tempered air and producing uniform temperature throughout the room.
To install simply set on floor and connect steam and return piping and wiring to motor.

Send for bulletin today

Bayley Mfg. Co. Dept. "E"
Milwaukee, Wisconsin

For many jobs—

especially theatres, factories and laundries—the low pressure Monsoon Multiblade Disc Fan is the ideal type.

Low in cost and power consumption, high in air volume. Equipped with SKF self-aligning ball bearings.

Monsoon Cooling System, Inc.
71 No. 6 Street, Brooklyn, N. Y.

The DUNHAM
REG. TRADE-MARK
HEATING SERVICE

99.2% Efficient!

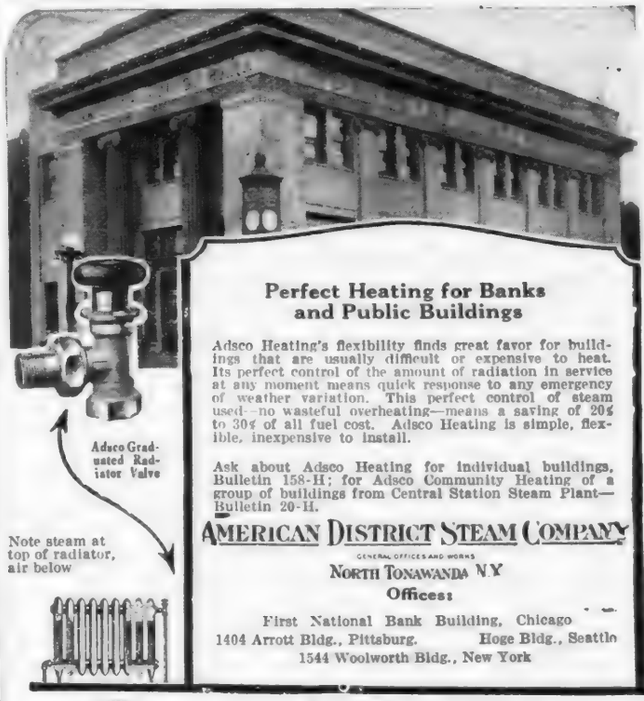
Laboratory tests showed a radiator equipped with a Dunham Radiator Trap to be 99.2% efficient.

Radiators that were not "Dunhamized" showed as low as 70% efficiency.

Send for bulletins describing the Dunham Heating Systems. They are of a convenient size for filing.

C. A. DUNHAM COMPANY
230 E. Ohio Street, Chicago

52 Branch and Local Sales Offices in United States and Canada.



Perfect Heating for Banks and Public Buildings

Adsco Heating's flexibility finds great favor for buildings that are usually difficult or expensive to heat. Its perfect control of the amount of radiation in service at any moment means quick response to any emergency of weather variation. This perfect control of steam used—no wasteful overheating—means a saving of 20% to 30% of all fuel cost. Adsco Heating is simple, flexible, inexpensive to install.

Ask about Adsco Heating for individual buildings, Bulletin 158-H; for Adsco Community Heating of a group of buildings from Central Station Steam Plant—Bulletin 20-H.

AMERICAN DISTRICT STEAM COMPANY
GENERAL OFFICES AND WORKS
NORTH TONAWANDA N.Y.
Offices:
First National Bank Building, Chicago
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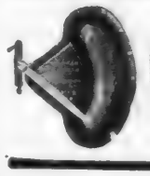


ADSCO HEATING

STERLING SYSTEMS

THE STERLING SYSTEM OF VAPOR HEATING means The Highest Quality

of

THERMOSTATIC RADIATOR TRAPS
PACKLESS RADIATOR SUPPLY VALVES
AIR ELIMINATING DEVICES
DAMPER REGULATORS

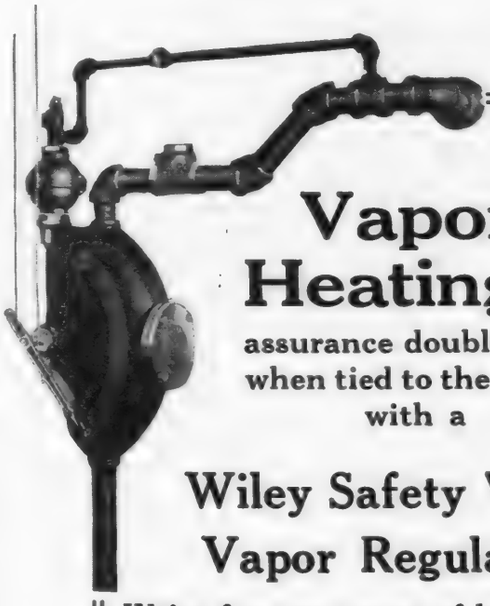
and

RETURN TRAPS

Coupled with highest quality of Engineering Service insuring a closed system of Vapor Heating of the highest possible efficiency.

Write for bulletins No. 32, Sterling System of Vapor Heating. No. 33, Sterling System of Vacuum Heating.

STERLING ENGINEERING CO.
419 - 3d Street, Milwaukee, Wis.
Manufacturers of Vacuum and Vapor Heating, Specialties.



Vapor Heating

assurance doubly sure when tied to the boiler with a

Wiley Safety Vent Vapor Regulator

Write for your copy of booklet describing the Wiley line of vapor heating specialties.

A peerless quality product manufactured and sold exclusively by

The Simplex Heating Specialty Co., Inc.
Lynchburg, Va.

BANNER ROCK WOOL QUILT
100% FIREPROOF
HOT SURFACE INSULATION

Before deciding on your requirements of Heat Insulation, investigate the remarkable results obtained from Banner Rock Wool Quilt when used as insulation for Boilers, Heaters, Breechings, Kilns, Ovens, Tanks, Tankcars, Water and Oil Stills and other hot surfaces.

MANUFACTURED BY

BANNER ROCK PRODUCTS CO.
ALEXANDRIA, INDIANA

QUALITY HEAT AND COLD INSULATION

Return Line Vacuum Pump

Read these four reasons and you will readily see why we claim our pump is the best of its kind.

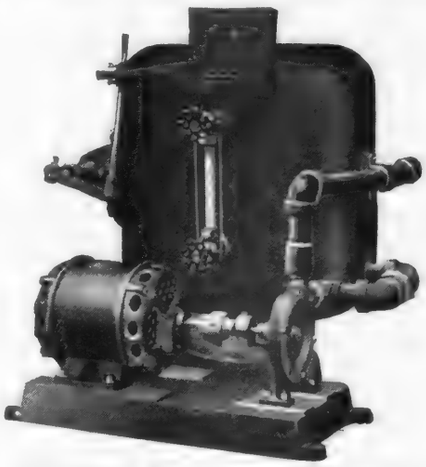
1. *Each element, ie., water and air, is handled by an individual pump, specially designed to handle its respective element and each pump is driven by an individual motor.*
2. *Double Automatic Control. Each pump is separately controlled so that the water pump operates only when water is to be returned to boiler, and air pump operates only when air is to be exhausted.*
3. *They are more efficient because the total horse power furnished is no more than any other efficient pump, and they run only as needed.*
4. *All pipe connections between receiver, air pump and water pump are made at the factory.*

10 more distinct advantages in bulletin 45, send for it immediately.

CHICAGO PUMP COMPANY

2325 WOLFRAM STREET *CHICAGO, ILLINOIS*

WESTERN AUTOMATIC ELECTRIC CONDENSATION PUMP and RECEIVERS



RELIABLE **SIMPLE**

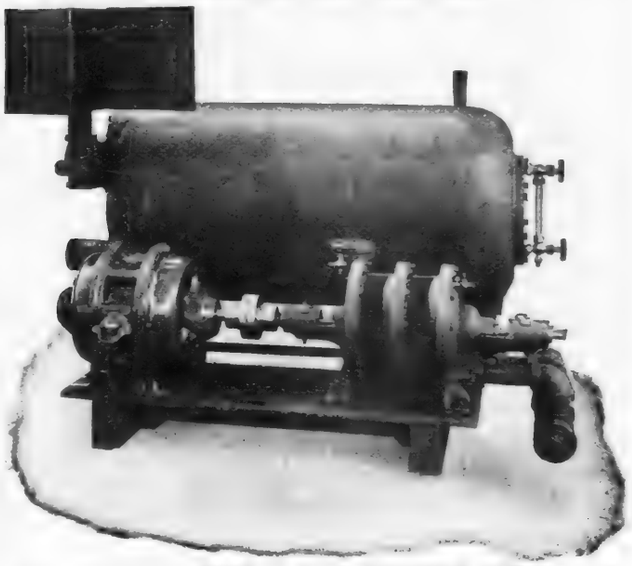
A single stage pump suitable for high or low pressure ranging from 10 lbs. to 100 lbs.

The unit is very compact, mounted on cast iron base, only two pipe connections necessary when installing. The receiver is made in two sizes, of heavy cast iron. An enclosed butt contact switch is used on all pumps.

Write for Bulletin No. 220

WESTERN ENGINEERING CO.
DAVENPORT, IOWA

YEOMANS
ELECTRICALLY OPERATED
CONDENSATION RETURN PUMPS
HORIZONTAL AND VERTICAL



SPECIAL TYPE H HIGH PRESSURE UNIT

RUGGED **RELIABLE**

Constructed to insure long life.

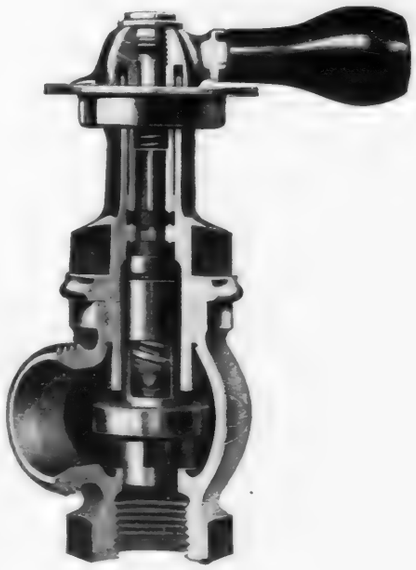
Superiority proven by years of experience.

Send for Bulletin C-5100

OMANS BROTHERS CO., 1421 Dayton St., Chicago, Ill.

Half the battle is won when you specify

LAVIGNE PACKLESS QUICK-OPENING STEAM RADIATOR VALVE



Sectional View
Lavigne
Graduated Packless Valve

Made of the highest grade materials for rugged service.

Six sizes, many styles of handles

All good jobbers handle them

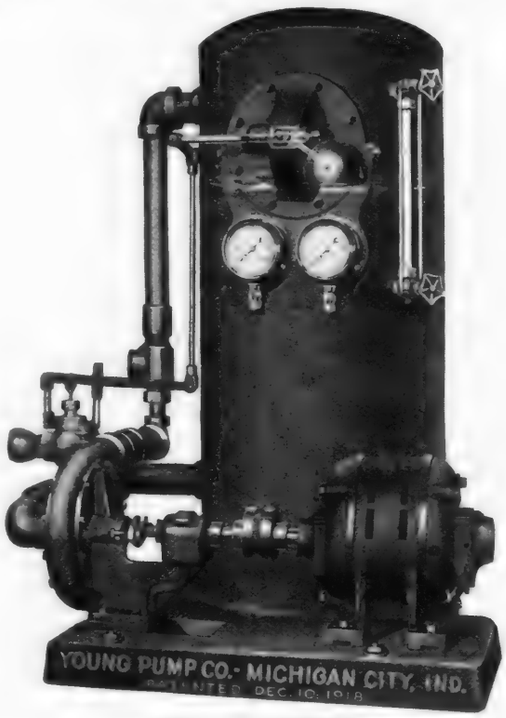
COMMONWEALTH BRASS CORPORATION

Detroit, Mich.

Young Centrifugal Vacuum and Boiler Feed Outfits

Consists of a centrifugal pump with motor direct connected, tank, exhauster and balanced by-pass valve. The pump, motor and tank are mounted on a substantial cast iron base and the outfit completely assembled as shown in the cut, so that as received on the job it is only necessary to make pipe connections to the system and boiler, wiring connections to the motor, when it is ready for operation.

It is the simplest outfit made. There are no valves, springs or other parts that require adjustment, wear out or cause repair expense; not a feature more complicated or liable to cause trouble than the motor.



Made in six sizes to handle 4,000, 8,000, 16,000, 26,000, 40,000 or 65,000 sq. ft. of radiation; for continuous operation or automatic control, to meet any condition or pressure.

Complete information and prices upon application.

Write for descriptive pamphlet.

CHICAGO OFFICE
327 S. LaSalle St. Phone Harrison 5920

CAPITOL PACKLESS QUICK OPENING VALVES

Have opposing seats.

Can be used on either pressure or vacuum systems.

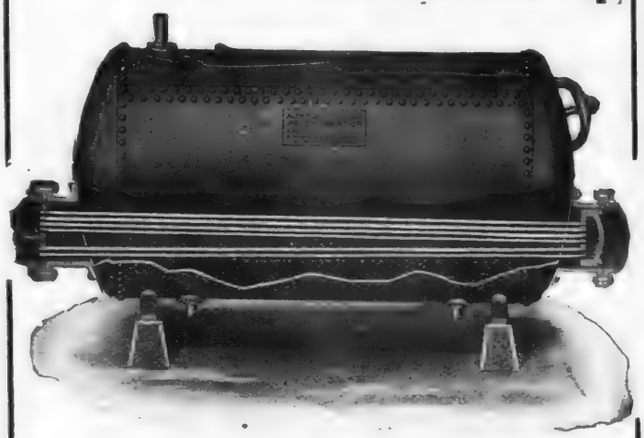
Perfect in every detail.

CAPITOL PRODUCTS ALWAYS SATISFY.

Write for catalog and prices.

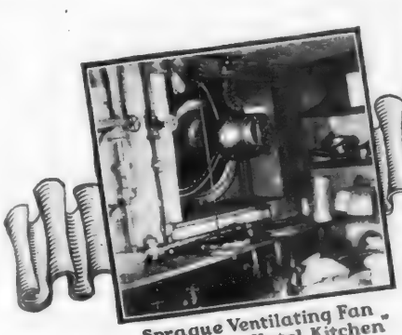
CAPITOL BRASS WORKS
Detroit, Mich.

OUR REPUTATION IS BEHIND THE ALBERGER "BUFFALO" STORAGE WATER HEATER

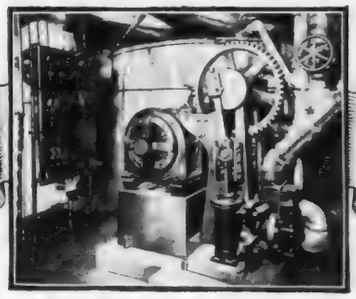


We would not risk this reputation by placing an untried product on the market. We make the experiments in our own shop and not in our clients' buildings. Our improvements are something more then experiments, they are accomplishments. Catalog No. 3 will give you a few interesting facts about heaters. Write for it.

Alberger Heater Company
BUFFALO, N. Y.
New York Offices: 1544 Woolworth Building



Sprague Ventilating Fan in "Mc Alpin Hotel Kitchen"



Sprague Pump Motor and control on Fire Pump "Loew's Theatre, N.Y."

Sprague Blower Motors in "Hill Publishing Plant"

SPRAGUE EQUIPMENTS SATISFY

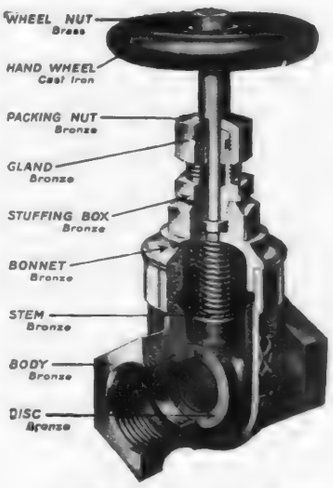
It Pays to Put in Equipment that Satisfies

Sprague Ventilating Fans, Pump Motors, and Blower Drives have stood the test of time. You will find them doggedly doing service day and night, down in the vitals of many conspicuous buildings in our great cities.

They can be depended upon. They are made *right* and are backed by one of the oldest manufacturers of electrical apparatus in the United States. Write our nearest Branch Office today.

SPRAGUE ELECTRIC WORKS
Of General Electric Company
Main Offices 527 W. 34th St. New York
PIONEERS OF THE INDUSTRY
Branch Offices in Principal Cities

What is Your Valve Standard?



Most any valve will work well when new, but it takes a high grade product to stand up for a long period of years and to continue to give one hundred per cent efficient service. That's why engineers and contractors should safeguard the future interests of clients and customers by specifying the KENNEDY. In this way their specification carries with it the protection which the KENNEDY name and guarantee insures to valve users.

KENNEDY

For 42 years valve satisfaction has been the one object of the KENNEDY organization, and the improvements and developments which mark all valves bearing their trade mark are sufficient proof of the success of their efforts. Special features embodied in the design for the distinct purpose of giving long life include:

Pipe threads of generous length which prevent leakage.
Accurate guides for seat which prevent contact of disc with seat until the valve is ready to close.
Stem of special bronze with high tensile and torsional strength.
Gland in stuffing box which eliminates leaks and avoids frequent repacking.

Other special features of Kennedy Valves are given in our latest catalog. Send for copy and keep it handy. 249

THE KENNEDY VALVE MFG. CO.

Branch Offices and Warehouses
NEW YORK: 95 John St.
SAN FRANCISCO: 23-25 Minna St.
BOSTON: 47 India St.
CHICAGO: 204-8 N. Jefferson St.

MEMBERS THE NATIONAL TRADE EXTENSION BUREAU OF THE PLUMBING AND HEATING INDUSTRY. PERMIT NO. REGISTERED

SALES OFFICES:
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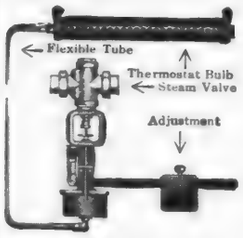
SALT LAKE CITY: 503 Dooley Bldg.
EL PASO: 704 Two Republics Bldg.

Man's Mind Makes Mistakes



The Powers Regulator No. 15

Specially adapted for control of air temperatures in leather dryers, ovens and kilns. Write for Bulletin No. 138. There are other Powers Regulators for other places—acid baths, hot water tanks, etc.

Wherever there is need for maintaining a definite uniform temperature—as in drying rooms, ovens, vats, kilns, etc.—men may forget—but machines cannot. You depend on your men to watch the temperatures but they are only human and, as careful as they try to be, they have sometimes allowed valuable hides to be spoiled.

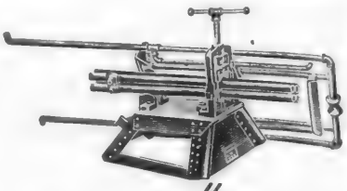
The Powers Automatic Heat Regulator

Built scientifically in accordance with known physical laws. Self contained; entirely automatic; can be adjusted to maintain any desired degree of heat; stays on the job every minute and does not **forget** to "turn 'er on" or off when the temperature even **approaches** the danger point. Prevents loss and damage and worry. Set the Powers Regulator and you can **depend** on results.

THE POWERS REGULATOR CO
Specialists in Automatic Heat Control

954 Architects Building, New York
2718 Greenview Ave., Chicago
565 Boston Wharf Bldg., Boston
The Canadian Powers Regulator Co., Toronto, Ont.
1236A)

Efficiency and Economy



are two necessary essentials for progress in every shop

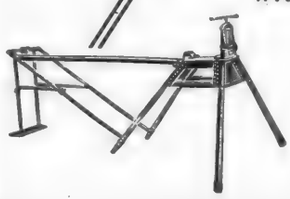
Can be assembled in a few moments and conveniently carried to any job.

USE THE

MARTIN
Portable Vise Stand and Pipe Bender
(Combined in one)

Insert legs in sockets—no nails, screws or fastening required.

Furnished with or without legs in both the large stand with chain vise for 4 in. pipe and hinged vise for 4½ in. pipe. Also smaller stand for lighter pipe.



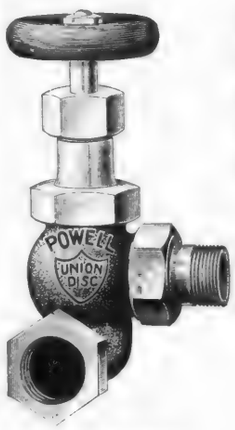
Write for our ten-day free trial and further particulars

H. P. Martin & Sons
618 E. 2nd St.
Owensboro, Ky.

Powell Valves

UNION COMPOSITE DISC VALVE

UNION DISC RADIATOR VALVES



Offset corner with male union

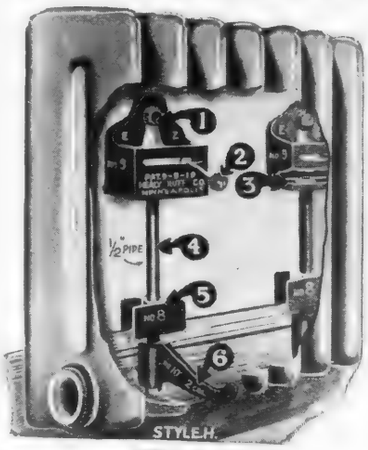
Made to suit every Requirement, with Unions and wood wheels, in Globe, Angle, Corner and offset patterns.

NOTE THE UNION BONNET CONSTRUCTION
Specify "POWELL" VALVES

Ask your dealer for Powell Valves or write us

The Wm. Powell Company
Cincinnati, Ohio

SIX IMPORTANT FEATURES of E-Z RADIATOR HANGERS



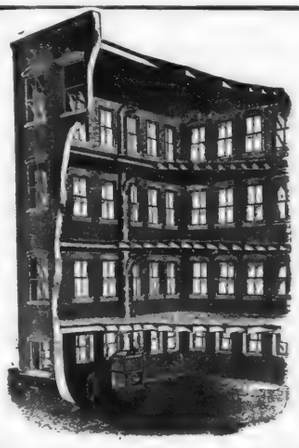
STYLE H

1. One Bolt
2. Invisible Washer
3. Horizontal Adjustment
4. Vertical Adjustment
5. **Adjustable for Baseboard**
6. Made for Wall, and Column Radiation

STYLE R
Without Baseboard Adjustment
Reasonable Price

Made for all styles of radiation

Manufactured by
HEALY-RUFF CO.,
Minneapolis, Minn.



PORBECK INDUSTRIAL AIR HEATER

Adapted for heating and ventilating large buildings. No need of distributing pipes. Takes full advantage of the laws of nature in the production of warmed air and utilizes these laws in providing an even distribution of warmth and comfort throughout the largest of buildings.

Sales representatives wanted

PORBECK MFG. CO.
1000 N. Market St., St. Louis, Mo.

Net Price (½" or ¾" size) $36

See Net Price List Below

The best hot water tank regulator obtainable. VICTOR.

Sold with an absolute GUARANTEE

NET PRICES

½" or ¾", $36; 1", $37; 1¼", $40; 1½", $41.50; 2", $43; 2½", $47; 3", $57; 3½", $62; 4", $67; 4½", $75; 5", $85; 6", $97.20.
Prices with larger control valves on application.
We also make Reducing Valves, Pump Governors, Damper Regulators, etc., fully described in Junior Catalog No. 21.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
281 South St., Newark, N. J.

CONNERSVILLE Vacuum Cleaners

State & Lake Theatre
Chicago

C. W. & Geo. L. Rapp and C. A. Lonsburg, Assoc., Architect, Chicago.

W. B. Tubby, Archt., New York.

East Ohio Gas Co., Cleveland, O.

In these Modern Buildings— there is Absolute Cleanliness

When the builders and designers of such palatial and beautiful buildings as these, adopt the CONNERSVILLE vacuum cleaning system to keep their buildings clean and healthful—there must be a strong reason for their choice.

CONNERSVILLE VACUUM CLEANERS stand the test, and please the most scrupulous and particular building owners and managers.

Whether it is the cleaning of luxurious carpets and hangings of the theater, or the hardwood floors of the office building—the CONNERSVILLE VACUUM CLEANER is ideally designed to do the work thoroughly and economically.

Direct discharging of all refuse to the sewer is an important CONNERSVILLE feature. CONNERSVILLE cleaners are always ready for action.

YOU'LL FIND CONNERSVILLE REPRESENTATIVES IN MOST IMPORTANT CITIES.

DEPARTMENT "C"

Manufactured by
LANDERS, FRARY & CLARK
United Vacuum Appliance Div.
Connersville, Indiana

PATTERSON

Preferred by those who recognize true merit in a water Heating System

Automatic, requiring no adjustment — and no attention whatever

Temperature is uniform under all variations of service

Time is saved by having an unlimited supply of scalding **hot water**

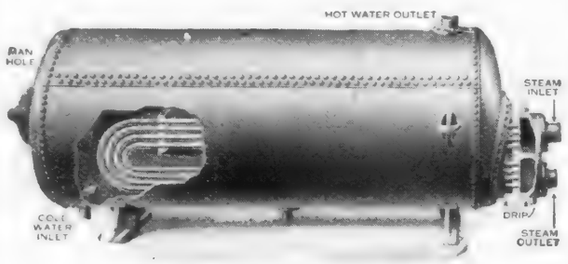
Efficient and economical. Materials and workmanship unexcelled

Reliable with nothing to get out of order and cause trouble and delay

Steam may be either exhaust, high or low pressure live steam

Operating cost is next to nothing no difference how long in use

Noted for supplying **Hot Water** for domestic or industrial purposes



The Patterson System of Water Heating for any Service

Patterson-Kelley Co.
23 Dey St. New York

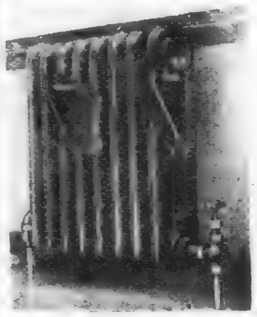
KATA-THERMOMETERS

For Sale by

SIEBE, GORMAN & CO.,
LIMITED

H. N. Elmer
General Agent for North America
1641 Monadock Building
CHICAGO, ILL.

HARTMANN
RADIATOR BRACKETS



WHY ?

LABOR SAVED
NO WALL STRIPS
NO BREAKAGE
NO DIRT
INEXPENSIVE

Send for descriptive circular

CHARLES HARTMANN CO.
Sheet Metal Constructors
985 Dean St., Brooklyn, N.Y.

Ross

Surface Barometric and Jet Condensing Equipments for Power Plants.
Main, Auxiliary, Distilling Condensers & Evaporators for Marine Service.
Distilling Condensers for Refrigeration and Chemical Plants.

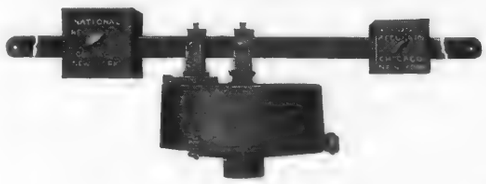
Crosshead Guided" Expansion Joints
Ross Boiler Feed Water Heaters.
Ross Oil and Sugar Juice Heaters.
Gravity & Forced Circulation Heaters.
Ross Oil, Air and Water Coolers.

ROSS HEATER & MFG. CO., Buffalo, N. Y.

THE BRAND THAT LEADING ENGINEERS DEMAND

HOT WATER

2" for Hot Water



7" for Low Pressure and Vapor

Made in 2", 4", 7" and 10" sizes

LOW PRESSURE

Metaphram Damper Regulators

For Low Pressure and Hot Water Boilers

also

Metaphram Regulators

For Hot water Tanks, Ovens, Pots, Driers, Refrigeration and other industrial processes.

Send for Circulars

THANE METAPHRAM REG U.S. PAT OFFICE

NATIONAL REGULATOR CO.
FACTORY AND GENERAL OFFICES
208-212 South Jefferson Street
CHICAGO

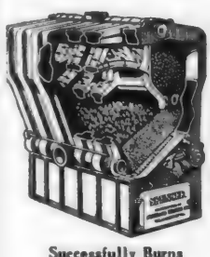
VAPOR

A-JACKS
for
HIGH PRESSURE

SPENCER Magazine Feed HEATERS

BUCKWHEAT COAL

Spencer Heaters are particularly designed to burn Buckwheat Coal which costs about one-third less than sizes used in ordinary heaters. It has as much heat value, when used in a **Spencer**, and requires no more tons. The normal production is more than six times the estimated quantity used for heating purposes.



Successfully Burns No. 1 Buckwheat

Spencer Heaters feed automatically, maintain a fire bed of uniform depth with steady heat, and require attention but once in 12 to 24 hours.

LESS COST LESS ATTENTION
Steam, Vapor and Hot Water Systems
Representatives in Boston, New York, Philadelphia, Baltimore, Buffalo Detroit, Chicago, Duluth.

THE STANDARD HEATER COMPANY

Williamsport, Pa.

Every Heating Engineer Knows the Advantages of Copper Over Iron

SPECIFY

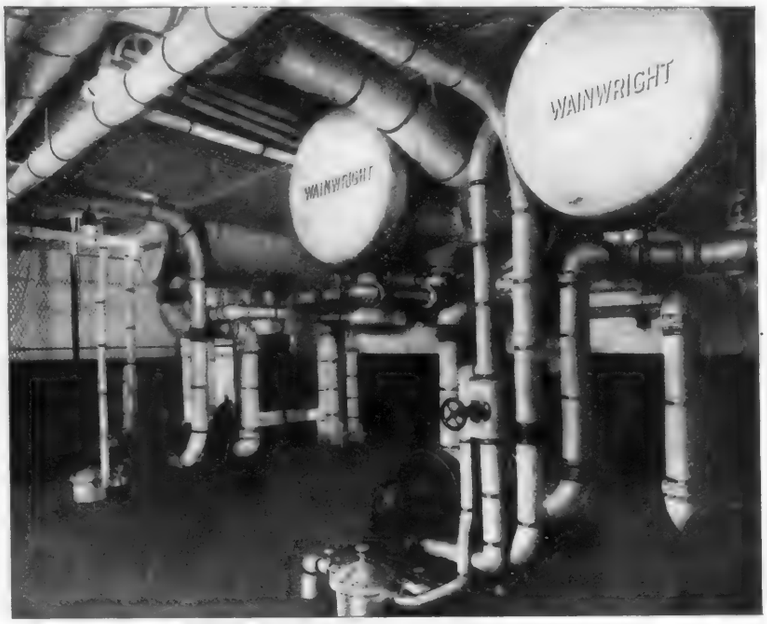
DAHLQUIST

Copper Boilers

Let us figure on your requirements

DAHLQUIST MFG. CO.
40 West 3rd St. BOSTON, MASS.

HEATING SYSTEM HEATERS



ALBERGER PUMP & CONDENSER COMPANY

140 Cedar Street, New York

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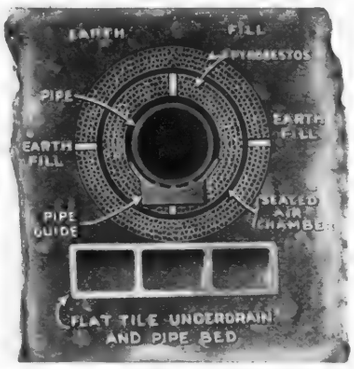

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Cannot rot or decay nor will it retain moisture to rust and destroy the piping during non-heating season.

Saves most coal, sends dry steam to a greater distance and by reason of its advanced common sense method of installation is at the same time a lower cost per foot of pipe covered than any other Underground Pipe Insulation on the market.

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THE EFFICIENT

RIC-WIL METHOD

means the practical elimination of heat losses. RIC-WIL installations commonly show efficiencies of 85% —there are cases where it has shown better than 90%. And not for a week or a month, but continuously, and after years of service. This means just one thing—economy—conservation of the coal pile. Economy is the *only* reason why underground pipes are insulated at all: it is the *best* reason why they should be insulated by the RIC-WIL METHOD.

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CLEVELAND

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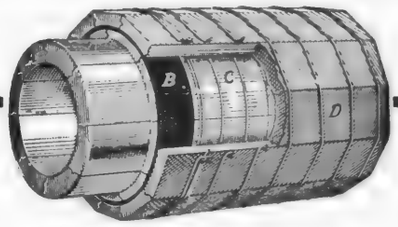

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B—Asphaltum Packing.
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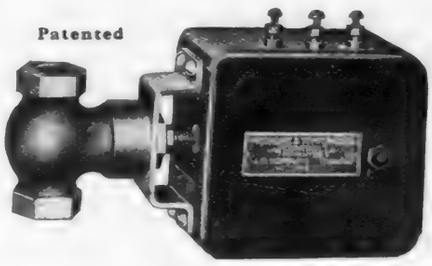

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Atmospheric Conditioning Corporation, Philadelphia, Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
Clarage Fan Co., Kalamazoo, Mich.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
Monsoon Cooling System, Inc., New York.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

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Atmospheric Conditioning Corp., Phila., Pa.
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Carrier Engineering Corporation, New York.
Clarage Fan Co., Kalamazoo, Mich.
W. L. Fleisher Co., New York, N. Y.
Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago. Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

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Jas. P. Marsh & Co., Chicago, Ill.

Air Separators
Griscom-Russell Co., New York.
Hoffman Specialty Co., New York.

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American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
Clarage Fan Co., Kalamazoo, Mich.
W. L. Fleisher Co., New York, N. Y.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Mellish Hayward Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

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Siebe, Gorman & Co., Chicago, Ill.

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Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Garden City Fan Co., Chicago, Ill
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown. Mass.
New York Blower Co., Chicago, Ill.
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Skinner Bros. Mfg. Co., St. Louis, Mo.
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Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
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New York Blower Co., Chicago, Ill.
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L. J. Wing Mfg. Co., New York.

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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
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Hartmann Co., Charles, Brooklyn, N. Y.

BOILER CEMENT.
Slur-Tite Mfg. Co., Cleveland, O.

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Dahlquist Mfg. Co., Boston. Mass.

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American Radiator Co., Chicago, Ill.
The Brownell Co., Dayton, O.
Gorton & Lidgerwood Co., New York.
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Illinois Malleable Iron Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Kewanee Boiler Co., Kewanee, Ill.
Oil City Boiler Works, Oil City, Pa.
Page Boiler Co., Wm. H., New York.
Standard Heater Co., Williamsport, Pa.
Titusville Iron Works Co., Titusville, Pa.
Utica Heater Co., Utica, N. Y.

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American Radiator Co., Chicago, Ill.
The Brownell Co., Dayton, O.
Herbert Boiler Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Page Boiler Co., Wm. H., New York.

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Kewanee Boiler Co., Kewanee, Ill.
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Titusville Iron Works Co., Titusville, Pa.

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Sarco Co., New York.
Schaefer & Budenberg Mfg. Co., Brooklyn, N. Y.

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Simmons Co., John, New York.

Air.
New York Blower Co., Chicago, Ill.

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Oil.
Griscom-Russell Co., New York.

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Alberger Heater Co., Buffalo, New York.
Alberger Pump & Condenser Co., New York.
American Radiator Co., Chicago, Ill.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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Sturtevant Co., B. F. Hyde Park, Boston, Mass.

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Sturtevant Co., B. F., Hyde Park, Boston, Mass.

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Hartmann Co., Charles, Brooklyn, N. Y.

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Sturtevant Co., B. F. Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

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Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Simmons, Co., John, New York.
Sturtevant Co., B. F., Hyde Park, Boston, Mass
Wright-Austin Co., Detroit, Mich.

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Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Ric-Wil Co., Cleveland, O.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Webster & Co., Warren, Camden, N. J.

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Autovent Fan & Blower Co., Chicago, Ill.
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Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Garden City Fan Co., Chicago, Ill.
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Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
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Crane Co., Chicago, Ill.
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Jenkins Bros., N. Y.

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Bishop & Babcock Co., Cleveland, O.
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Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

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Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

Ounce Graduated.
Jas. P. Marsh & Co., Chicago, Ill.

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American Dist. Steam Co., North Tonawanda, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Webster & Co., Warren, Camden, N. J.

Vacuum.
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Bishop & Babcock Co., Cleveland, O.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Taylor Instrument Co., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

Water.
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American District Steam Co., No. Tonawanda, N. Y.
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Detroit Lubricator Co., Detroit, Mich.
Jenkins Bros., New York.

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Clarage Fan Co., Kalamazoo, Mich.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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Monsoon Cooling System, Inc., New York.
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Fulton Co., Knoxville, Tenn.
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By R. M. Morrison,
Chief Engineer.

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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
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Alberger Heater Co., Buffalo, N. Y.
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Excelso Specialty Works, Buffalo, N. Y.
Griscom-Russell Co., New York.
Patterson-Kelley Co., New York.
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Alberger Pump & Condenser Co., New York.
Griscom-Russell Co., New York.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Simmons Co., John, New York.
Sims, Co., Erie, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water (Open).
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Sims Co., Erie, Pa.
Webster & Co., Warren, Camden, N. J.

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Griscom-Russell Co., New York.

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Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

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Unit Blast.
American Blower Co., Detroit, Mich.
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Ilg Electric Ventilating Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co. New York.

Unit Air.
H. W. Nelson Co., Moline, Ill.

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Alberger Heater Co., Buffalo, N. Y.

Vacuum.
Bishop & Babcock Co., Cleveland, O.
Dunham Co., C. A., Chicago, Ill.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

Vapor.
American District Steam Co., No. Tonawanda, N. Y.
Dunham Co., C. A. Chicago, Ill.
Haines & Co., Wm. S., Philadelphia, Pa.
Ideal Heating Equipment Co., Cleveland, O.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Il.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mouat-Squires Co., Cleveland, O.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Co., Milwaukee, Wis.
Sarco, Co., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

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American Blower Co., Detroit, Mich.
American Moistening Co., Boston, Mass.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Air Conditioning Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
Douglass & Co., Thos. J., Chicago, Ill.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

HUMIDITY CONTROL.

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American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Engineering Corporation, New York.
W. L. Fleisher Co., New York, N. Y.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

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Taylor Instrument Cos., Richester, N. Y.

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Electric Measuring.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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Bailey Meter Co., Cleveland, O.
Stark Sheet Metal Works Co., Canton, O.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Sarco Co., New York.
Standard Thermometer Co., Boston, Mass.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

INSULATING MATERIALS.

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Hornung, J. C., Chicago, Ill.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Wyckoff & Sons, A., Elmira, N. Y.

MANOMETERS.

Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

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American Blower Co., Detroit, Mich.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
L. J. Wing Mfg. Co., New York.

METERS.

Condensation.
American Dist. Steam Co., No. Tonawanda,
Hornung, J. C., Chicago, Ill.

Feed Water.
Simmons Co., John, 110 Center St., New York.

(Feed Water (Wier Type).
Webster & Co., Warren, Camden, N. J.

Pitot Tube.
American Blower Co., Detroit, Mich.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

Steam.
American District Steam Co., No. Tonawanda, N. Y.
Bailey Meter Co., Cleveland, O.

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Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

OZONATORS.

Ozone Pure-Airifier Co., Chicago, Ill.

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Simmons Co., John, 110 Center St., New York.
Wrought Iron.
Simmons Co., John, 110 Center St., New York.
Wood.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE BENDING.

Buffalo Forge Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
H. P. Martin & Sons, Owensboro, Ky.
Simmons Co., John, 110 Center St., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

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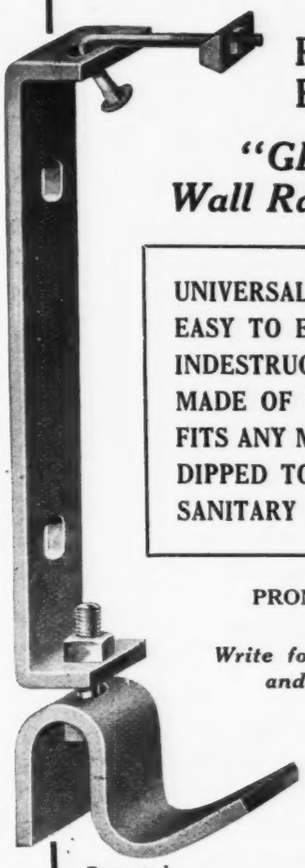

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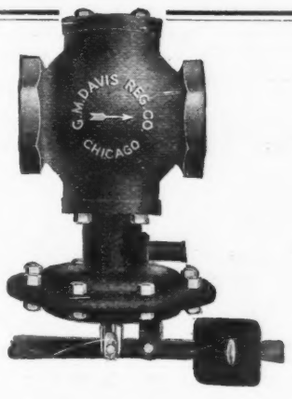

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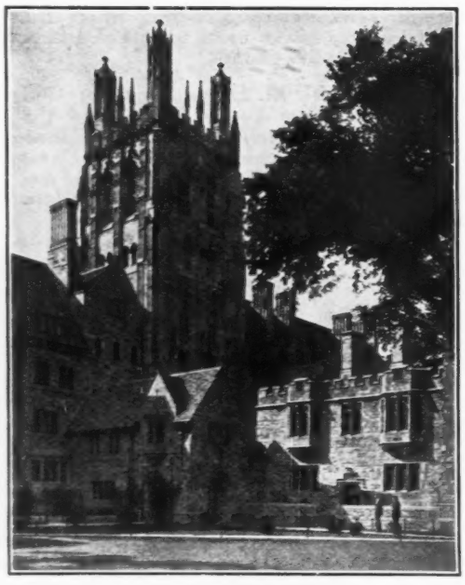

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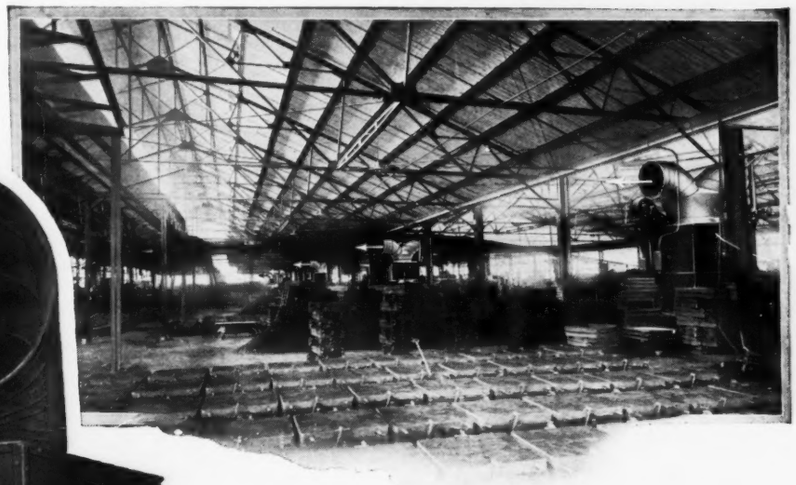
Showing installation of Skinner Bros. (Baetz Patent) Heaters in foundry of Best Foundry Co., Bedford, Ohio. Note extensive area served.



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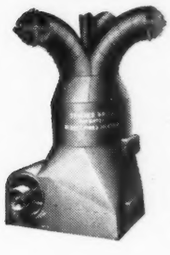

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Where steam is not available, we supply our direct-fired type DF, which burns coal, coke or wood. Built on the same scientific principle as type SC. The fan is operated by any power available.

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